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Electrical World

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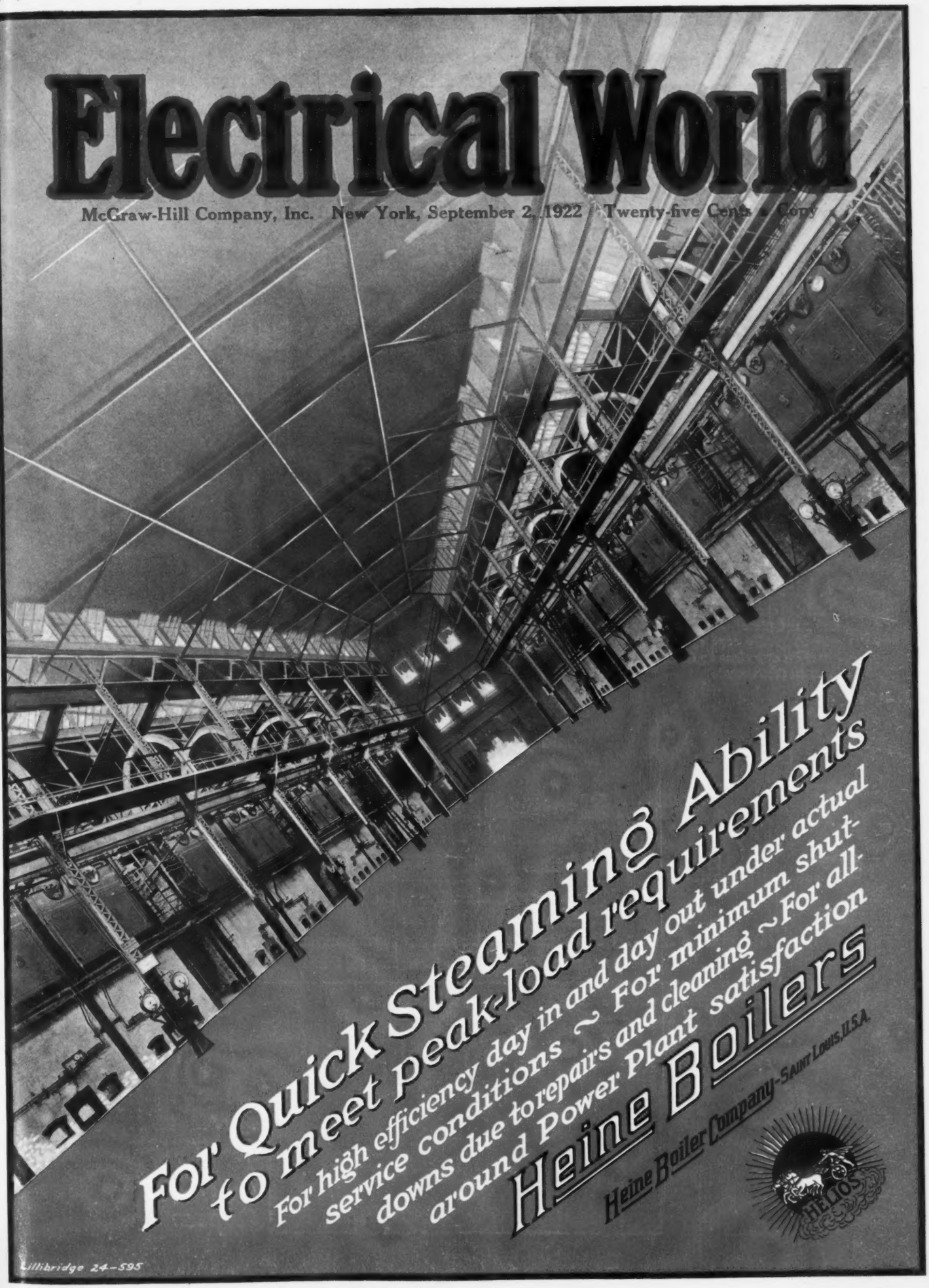
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Local Work Comes First

WHEN all is said and done, it is the local work that will make the present movement for business development in the electrical industry a half success or a real one. What men do for themselves in their own towns will measure the achievement.

Associations may convene, societies may operate, committees may discuss, national headquarters staffs may labor, all in close co-operation. But watch the cities.

WE HAVE at the head of things two organizations. Both have the same purpose—to promote electrical business—but they are quite different in power and responsibilities. Each has an element of strength and one of weakness.

The Joint Committee for Business Development has no staff or equipment, but it has the direct support and authority of the organized industry. It represents officially the associations of all classes of electrical men. The Society for Electrical Development represents only individual members and has no official "tie-in" with the organized industry, but it has an office, an equipment, a personnel and an experience in publicity and sales-promotion service to the industry. The society cannot hand over its possessions to the joint committee; the joint committee cannot delegate its authority to the society. But being supplemental to this extent they can combine in the work to great mutual advantage.

There are two kinds of work to be done: field work and headquarters administration. Of the two the field work is of course the more vital. For the message must be carried to every city that more local leagues may be formed and community effort inspired. By such leadership for a comparatively small expenditure, and appropriations that would not be burdensome on any group or any interest, it should be possible to carry on the program and stimulate the productive spending of infinitely larger sums applied in local activities. And there is where the money should be raised and used.

The opportunity stands out clear-cut therefore. The way to do this job is known, the machinery for doing it is ready and operating. We should soon see progress.

THE idea of a nation-wide movement to promote all electrical business has taken hold. The jobbers and the contractors are co-operating in a survey of all cities to see who are the best men to lead in each community. Ten more towns are already organizing. A national conference of league representatives is to be held next week. Many manufacturers and utility groups are co-operating.

But inevitably it will be the local planning, local selling and local financing that count. And it cannot be urged too strongly upon the central-station executive in each city to take the leadership in this local work and act at once. Moreover, the prompt service of these local workers should take precedence over all other interests at headquarters.

Herbert A. Barre

An engineer who has been intimately connected with Western hydro-electric developments.

CALIFORNIA and hydro-electric development are almost synonymous to the electrical engineer and others engaged in the light and power industry. A combination of elements has conspired to cause California to lead the rest of the world in hydraulic development. Immense resources in water power, a seaboard industrial district miles from the power sites, a climate that is famous and an enormous industrial activity stimulated by the environment and strategic trade situation—all these elements rendered it necessary that the exploitation of water power and the erection of transmission lines should be on a mammoth scale.

One of those who typify the engineers who have made possible the engineering achievements of California is Herbert A. Barre, executive engineer of the Southern California Edison Company. He is an example of those "sons of the Golden West" who have created an industrial empire and made the deserts blossom—one of those engineers who had the courage and vision to bring about the large interconnected power and transmission systems which render California immune from the effects of coal strikes and assure to the state an abundance of reliable power to develop her resources.

Mr. Barre was born in Nova Scotia, Canada, in 1875, but moved to California while still a youth. He attended the public schools of the state and was graduated from the University of California in 1897 with the degree of E.E. After his graduation Mr. Barre was engaged in railway and power-house construction work near San Francisco, and in 1902 he was associated with the Huntington properties in Los Angeles, where he was intimately connected with the development of the Los Angeles Railway, the Pacific Electric Railway and the San Joaquin Light & Power Company.

In 1906 Mr. Barre became an engineer for the Electric Bond & Share Company of New York and was engaged in valuation, appraisal and general engineering. In 1911 he became an electrical and mechanical engineer with the Pacific Light & Power Company of Los Angeles, retaining the same title when the Southern California Edison Company was formed in 1917, but recently exchanging it for that he now bears. In the service of these companies he has been connected with the Big Creek development and with the 150,000-volt transmission system.

Mr. Barre is well known and active in all engineering affairs. He is an active worker in the American Institute of Electrical Engineers and the National Electric Light Association and has served as an officer in these organizations. The electrical industry in the West has no more ardent and worthy supporter than H. A. Barre.

Editorial Comment

Electrical World, September 2, 1922

Volume 80 Number 10

Getting Together on Transmission

MOST of us are left behind when one of the few theoretical transmission-line experts appears before a convention to give a paper on late developments. Not a few transmission-line operating engineers, in fact, admit more or less ignorance of precise calculations of transient phenomena which involve hyperbolic functions and differential equations. It is not disputed that it is valuable to know these things in order to design, install and operate a modern high-tension system, but the claim is made that lack of time has prevented engineers in the field from keeping up with the subject. Consequently they feel entirely out of place in theoretical discussions.

The art of transmission has advanced by leaps and bounds, and means should be found to advance the educational status of all engineers on this subject. At conventions it is well to encourage the few experts to discuss the problems in their own language, but steps might also be taken to have the material presented to the rank and file in terms readily understood. We venture to assert that a graduate electrical engineer can grasp the essentials of hyperbolic functions and the differential equations required for transmission-line solutions in a very few lectures and would accept with pleasure any opportunity for hearing the subject developed by the experts.

"What's the Constitution Among Friends?"

ADMIRABLE in its simplicity and directness is the plan of the city government of Lima, Ohio, to insure good service at reasonable rates from the Ohio Power Company. To this end the municipal authorities insist on inserting in their proposed contract with the company the clause printed elsewhere in this issue of the *Electrical World* which bars the State Public Utilities Commission from participation in any controversy that may arise during the life of the franchise. With the unreasonableness and lack of public spirit characteristic of utilities, the company objects to thus obliterating the commission from the landscape; but the municipal finger has written down the happy thought of the municipal brain and has refused to cancel half a line of it.

The only trouble with the plan is that it does not go far enough. With the police power of the state thus waved aside, there remain the courts—reactionary bodies prone to obstruct and interfere. Why not perfect the agreement by adding another clause, in words to this effect: "And it is further agreed that no appeal to the courts, state or federal, shall be made, and that the state and federal constitutions, and in particular the Fourteenth Amendment to the latter instrument, are in all matters covered by this franchise null and void"?

In this way the tail will wag the dog; the municipal government of Lima—whose political guide is evidently that famous Bowery statesman who demanded to know why the Constitution should stand between friends—will free itself from the jurisdiction both of Columbus, Ohio, and Washington, D. C., and public service companies all over the country will receive an admonitory hint. Seriously, Lima's City Commission will have to think again.

The Accomplishments of Gisbert Kapp

WITHIN the short period of a month the electrical industry—indeed, the whole world—has lost two great pioneers in two widely different yet closely related fields. As we still mourn the loss of Alexander Graham Bell there comes the news of the death of Gisbert Kapp. It is, indeed, the melancholy task of the chronicler of events to add almost day by day new names to the list of those who have answered for the last time the roll call of "the thought-worn chieftains of the mind, head servants of the human kind."

A generation which takes for granted all that creative genius has wrought within the last half century passes by without much notice or thought the disappearance of the creative minds of Bell and Kapp. As Bell was associated with the invention, evolution and creation of the machinery for the transmission of speech, so Kapp was associated with the creation and evolution of the machinery for the transmission of energy.

Our knowledge of the principles and the theory of electrical machines may well be dated from 1885, when, almost simultaneously, Dr. John Hopkinson and Gisbert Kapp developed the theory of the magnetic circuit, which is the fundamental principle on which dynamo design is based. Here, as in the case of Bell, we find the curious phenomenon of codiscovery, and as Bell had his Elisha Gray so Hopkinson had his Kapp. Hopkinson's masterly exposition was surely well supplemented by Kapp's remarkable capacity for lucid explanation and clarity of thought. The great influence exerted by Kapp in the design of direct-current dynamos and his mastery of alternating-current theory made him one of the central figures in the days during which the fabulous growth of electrical engineering occurred. Grasping the great importance of a clear physical understanding of alternating-current theory, he developed the "Kapp" vector diagrams, by means of which he explained some of the most complex phenomena, such as those observed by his friend Ferranti in the latter's 10,000-volt transmission from Deptford to London.

The clear demonstration between Lauffen and Frankfort-on-Main of the transmission of electrical energy at 30,000 volts gave an impetus to Tesla's invention of polyphase electric currents, the importance of which no one more clearly seized upon than Gisbert Kapp. His treatise on the "Electric Transmission of Energy" marks an epoch in electrical engineering. It was not

his only noteworthy treatise, as works on dynamo design as well as numerous scientific papers and inventions help to form his contribution to the art of engineering, to which he was devoted. A notable figure, a character pure and generous, he holds up to this generation of engineers the highest ideals and standards. With him has passed away one of the great men of our profession.

Designing Meters to Conform to Rate Systems

IT HAS often been said that the rapid development of the electrical industry has been due to the early and continued possession of accurate measuring instruments. The voltmeter, ammeter and watt-hour meter are the most accurate devices used to measure energy in any of its manifestations.

But now meters are desired to measure energy in a way to conform to logical rate systems. The measurement of demand, power factor and reactive kilovolt-amperes and the separation of primary and secondary power inherently tend to force meter designers to produce inaccurate instruments. The question of cost also enters into the situation, and an economic problem is involved in serving all customers with such complicated meters. Another difficulty is the maintenance and repair of the meters, which require the services of expert engineers. Any one familiar with the long, slow educational process required to produce a good meterman realizes the impossibility of educating the public to a degree where it would understand the technical reasons back of the complicated measurements.

However logical may be the tendency toward complicated rate systems, there are problems connected with their application whose solution will call for strenuous efforts by metermen and publicity men alike. The whole question is vitally important and worthy of thorough study and investigation.

Potential Gradient of Suspension Insulators

THE unequal distribution of the total potential to ground over the several units of a string of suspension insulators was recognized very soon after their introduction. So also was the influence of the capacities to ground of the metal parts as the disturbing cause. Therefore engineers have known for a number of years that by means of relatively simple modifications of design of the units and their attendant hardware a practically uniform potential gradient over the string could be obtained. It is merely a question of the proper proportioning of the successive capacities between units and to ground. However, these expedients have hardly been applied in practice at all. Operating companies have feared the complication and expense attendant upon the use of several different types of unit. Consequently effort has centered on the construction of a single unit which would withstand the maximum stress of the line end of the string, although this may often be twice as great as that on other units in the same uniform string. It has simply been a case of the end not being worth the means.

However, with the recent tendency to voltages up to 220 kv. it has been realized that advantage must be taken of some, if not all, of the several obvious means that have been suggested for equalizing the duties of the successive units in a string. The confidence expressed in the practicability of 220-kv. insulation is founded on the realization that with uniform potential gradient safe insulation is only a question of the number of units. The methods so far adopted in the experiments of Ryan, Peek and others have centered more particularly on the hardware and have shown the immediate value of a ring or other extended conductor at the line end in increasing the capacity of the adjacent units and so reducing the stress over them.

However, the shape of the porcelain itself, as well as that of its metal parts, can be utilized to the same ends. New data on this phase of the subject are presented in an article by D. F. Miner in this issue. Results are given of tests of potential gradient for strings of mixed types of unit, including one especially designed for high capacity. Particularly interesting are the photographic studies of the distribution of stress in the electric field surrounding an insulator unit. With continued experimentation of this character one of two things should be expected. The results may lead to the use of composite insulator strings for the highest voltages, consisting of some form of extended conductor at the line end and two or more different forms of porcelain units, possibly with graded spacing, in the string, or they may show that the operating benefits are not worth the cost.

Changes in Street-Lighting Feeder Practice Necessary

WITH the present great demand for more illumination on streets and highways, it might be well to consider existing methods of feeding street lamps and determine the general tendencies. We find that of late most operators on looking into their operating costs have found conditions which were non-existent when street-lighting and highway-lighting business was of small importance. The present rapid rise of the actual kilovolt-ampere load of that business points to the necessity of finding new methods of handling it in order to keep the cost down or reduce it as should be done to stimulate the demand still further.

The principal source of large expense in handling street-lighting load possessing a small kilovolt-ampere capacity per square foot is the fact that substation space must be provided for the installation of arc machines, rectifier outfits or tub transformers. From the substation, in general, the circuits run through single-duct lines, the cable usually carrying a very small amount of energy, at the most between 60 kva. and 80 kva. If many street-lighting cables have to be brought out from one substation, the available duct space will soon be used up and it will be impossible to bring out other cables that handle more load.

These two conditions mean a very high fixed charge per unit of energy for street lighting both in the substation space and in the duct line. It is therefore at these two places that the remedy must be applied. When the energy feeding the street lamps goes out on the underground or on the overhead power lines and these lines are used as connections between various lamps, the original investment per kilovolt-ampere is very much decreased. It is not negligible, but deserves less immediate attention than do the two other conditions.

The first step, which has already been taken by a number of companies, to reduce the amount of space

occupied in the substation and the duct line is to use one controlling distribution circuit to feed a number of outdoor series transformers installed in manholes or on poles. This step in itself has reduced investment to a large extent. Further steps seem to be promised in the use of "wired wireless" in the operation of switches on outdoor transformers that will close and open switches on the street-lighting transformers fed directly from the distribution circuits.

It is possible to imagine still greater economies resulting from individual control of each lamp connected on the secondaries of the distribution system by means of a very inexpensive piece of apparatus. It is evident, however, that this last step must be taken only after a thorough study of the economies involved. There is no question that at present the most economical means of handling street-lighting work is a distribution circuit of relatively high kilovolt-ampere capacity controlling and feeding a number of outdoor transformers which in turn feed a relatively small series of circuits, of, say, 20-kva. to 30-kva. capacity.

With the present development of the art the greatest drawback to the use of the direct-current arc is the substation space required for its machines or its rectifiers. The trend of development shows that the incandescent lamp will probably, for a time at least, prove to be the most economical method of street lighting.

For the Small-Plant Engineer

TO THE man who is about to install his first underground system or whose experience in such work is limited the article in this issue by William S. Jones on "Underground Construction Suggestions" should furnish data which will be of great value. Many engineers and operators in small and medium-sized cities are facing the necessity now of installing a certain amount of underground construction, though a few years ago aërial work met all requirements for the distribution of energy. This condition is brought about by increased density of load, by the enlargement of the power stations and by a desire on the part both of the community and the central-station company to remove overhead lines where these detract from efforts for the improvement and beautifying of streets and boulevards. One can find in this article specifications that will cover all the principal materials for duct-line construction and their proper installation. These specifications are given by a man of wide experience in this work and represent a safe guide in general underground construction.

Although a relatively small number of engineers are in constant contact with underground construction, and therefore have adopted their own standards based upon their own experience, the majority now obliged to install such construction will, we think, be greatly assisted in their search for information by studying this article. As Mr. Jones himself admits, his contribution presents no pioneer methods or ideas, but it does broadcast valuable information to many who are in great need of it. The result should be an improvement in the methods in underground installation in many places where this form of distribution has just started. The information should save operators considerable trouble and worry and show them how to install durable and satisfactory duct lines, with a resulting economy of operation.

Extravagant Claims for the Lead-Hydrate Battery

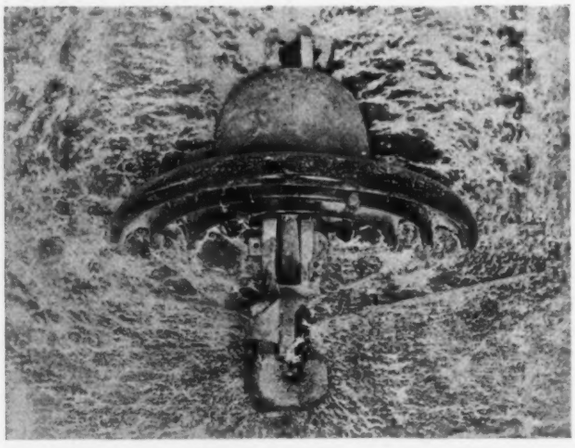
CERTAIN laws of nature are so familiar to us as to excite no wonder at their mystery. Others, not so obvious in daily experience, are not only surrounded for us with mystery but they often take on the air of the supernatural. The unfolding phenomena of electricity and magnetism are examples of the latter class, and this atmosphere of transcendent powers is often utilized by unscrupulous promoters for strengthening the claims of new devices or methods. The situation is all the more dangerous for those tempted to invest under such circumstances because of the fact that there actually have been many instances of new discovery so important and marking so long a step forward as to make the mind peculiarly receptive to news of even further wonders.

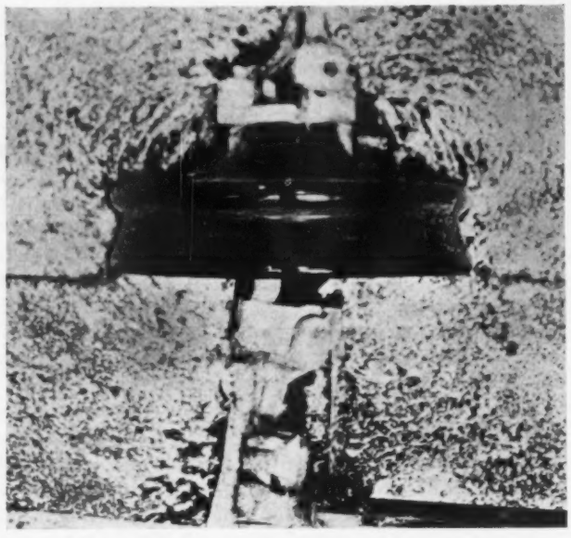
It should be possible in most cases to answer definitely the question as to the actual value of any new electrical device. Of the very first importance is the manner in which the new announcement is made. Secrecy, on the grounds of protection or other cause, is always a danger signal. Even when full information and details are given, competent expert opinion should be invoked before giving sure credence to claims. A further signal for caution is in the extravagance of the claims for the new device. In such a case it is all the more important that sound engineering evidence or opinion be demanded before giving credence or support. Occasionally there arise cases in which no new discoveries are claimed, but only improvements in old methods. These are more difficult to analyze, for not only are their promoters usually honest in their beliefs, but also the device may show an initial or superficial value and actually require the test of time.

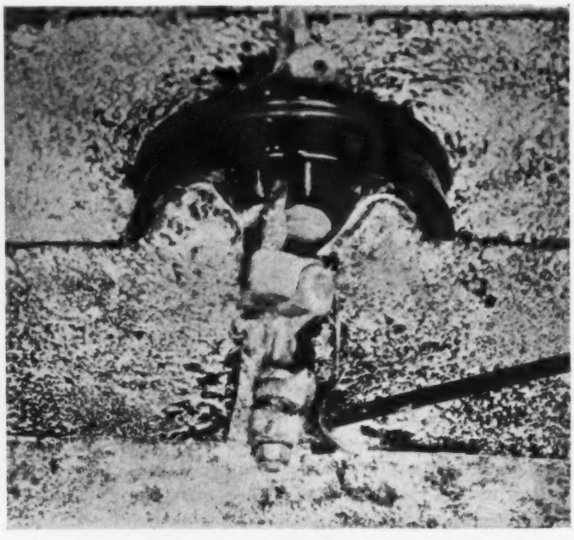
For some months past attention has been directed to the so-called lead-hydrate storage battery, recently announced by a responsible English firm, for which extraordinary claims as to performance and weight are made. The claims made for this battery are so remarkable and so far beyond the well-known possibilities of lead batteries as almost to stamp the new battery with suspicion from the start, were it not for the sound reputation of the firm that is offering it. It is well known that the output per unit weight of the lead storage battery falls far below the theoretical maximum, the limitations being caused largely by the difficulty of maintaining structural integrity and reasonably permanent electrical characteristics. This gives the opportunity for improvement, and the announcements of the performance of the new cell have taken such unrestrained advantage of these opportunities, and are so glowing, as to give it the earmarks of the usual sensational stock offering. There have been many announcements of similar new batteries in the past, and bygone experience suggests for the lead-hydrate battery the short life and collapse of claims which have characterized so many others.

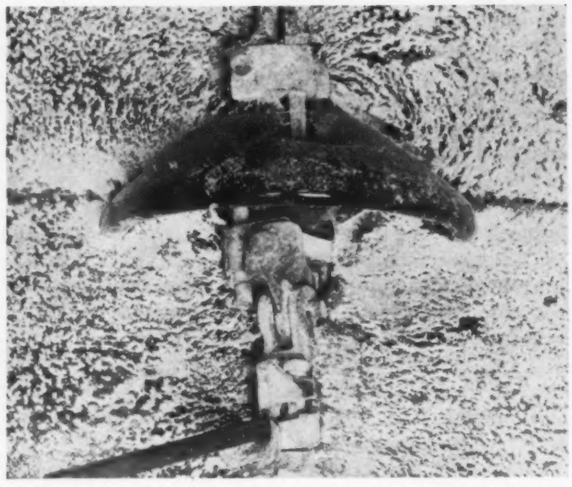
Obviously the expert has not yet had a chance at this battery. The present situation can only be accounted for by supposing that the promoters and manufacturers did not have the advantage of the best engineering opinion before offering a lead battery which apparently contains no new features and which claims capacity and life surpassing from two to six times the performances recognized as marking the limits of conservative design.

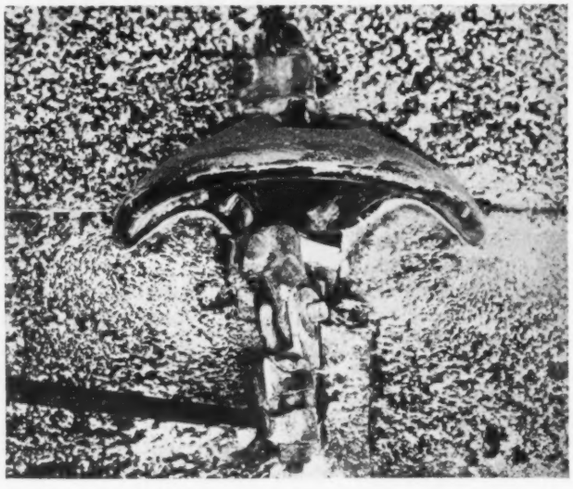
Dielectric Requirements of Insulators Should Not Overshadow the Mechanical











AFTER the best mechanical design has been determined for insulators they should be adapted or modified to give good dielectric flux distribution. Too often good porcelain design is entirely offset by improper use of hardware, when a little more care would give good electrical and mechanical properties. At other times dielectric flux distribution and arrangement is almost totally sacrificed to obtain long creepage surfaces.

Examples of units in which the mechanical and electrical characteristics might be better co-ordinated are shown. In the two uppermost views the mechanical features of design and support interfere with the ideal stress distribution; the stress is greatest at the end of the clamps. In the middle set the field form is good below the disks but bad above; the stress is greatest at the rims of the flange. In the right-hand unit the stress is distorted near the bottom of the shed. The units in the lowermost set show another type which conforms more nearly with the equipotential dielectric surfaces. When wet this unit has high stress at the edge of the rain shed, but the field distribution is still very good.

Composite Insulator Strings Improve Distribution of Dielectric Stress

Detailed Analysis of Dielectric Fields Surrounding Insulator Hardware Indicates How to Produce Uniform Stress—Use of Disks Having Different Values of Capacity Helpful

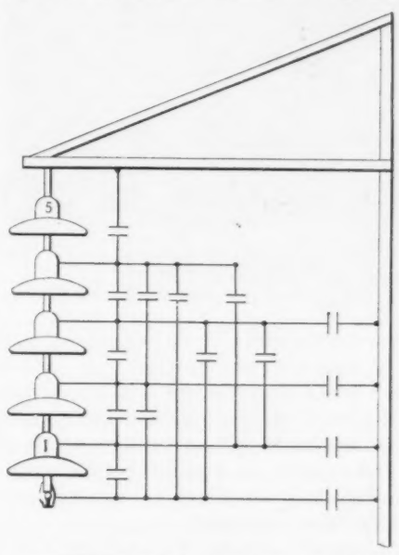
By D. F. MINER

Material and Process Engineering Department, Westinghouse Electric & Manufacturing Company

NOT many years ago "bulk insulation" was the rule. That is to say, insulators were formed chiefly with mechanical considerations in view, and then a sufficient amount of insulation was added to withstand the test necessary. Only when the requirements became more severe were attempts made to design insulation members rationally. This demands efficient use of the right materials and design of electrical parts to distribute the electrical load properly. In both problems potential gradient and stress distribution are important factors.

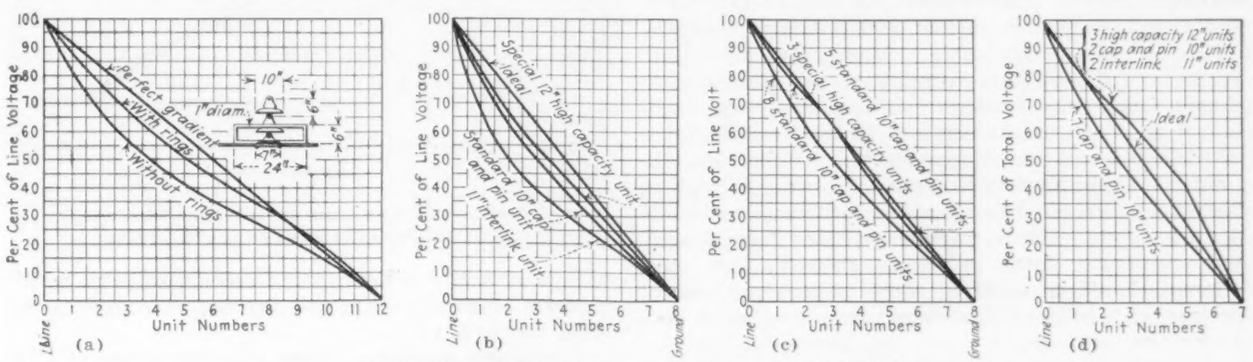
The potential distribution from line to ground in a string of suspension insulators is determined by the individual capacity of units and combinations thereof. This has been determined to be about 0.000023 microfarad for the standard 10-in. cap-and-pin-type unit. The interlinked type, because of less metal, has a capacity about one-half of this. There also exists a capacity of each set of hardware to ground and to the line wire, and also the capacity of each metal section to combinations of the others, as shown in a schematic diagram. Of these four classes of capacity existing, only the internal capacity of units and the capacity to ground are of appreciable value. The charging current of succeeding units must flow through the units nearer the line. Thus, in a string of five units the charging current for the five must flow from the line through unit No. 1. Through the second unit must flow the charging current for Nos. 2, 3, 4 and 5. Considering this situation alone the voltage across the units is unequal, that across the line unit being the greatest and that across the ground unit lowest. But the capacities between units affect this distribution, tending to make the middle unit assume the least potential stress. The net result, as is well understood, is to give the string a potential gradient curve which droops from line to a unit beyond the center and then rises some.

Several methods of representing the electrical stress load on units of a suspension string are available. The two most used are the potential-gradient curve and the individual-stress curve. In the gradient curve a uniform distribution would be represented by a straight line from 100 per cent to 0 per cent between the abscissa point of the line and ground. The usual way of numbering units is from line to ground so that No. 1 represents unit at highest potential. The curve may slope up from ground to line or down from line to ground, depending on personal point of view. Actual gradients droop below the line of uniformity, with the steepest slope at the line end. Composite strings and shielding devices alter this curve and change the slope. The usual effort is to reduce the slope at the line end. Gradient curves show the potential of the metal parts between insulating members and indicate the amount by which the slope must be changed to approximate the ideal slope.



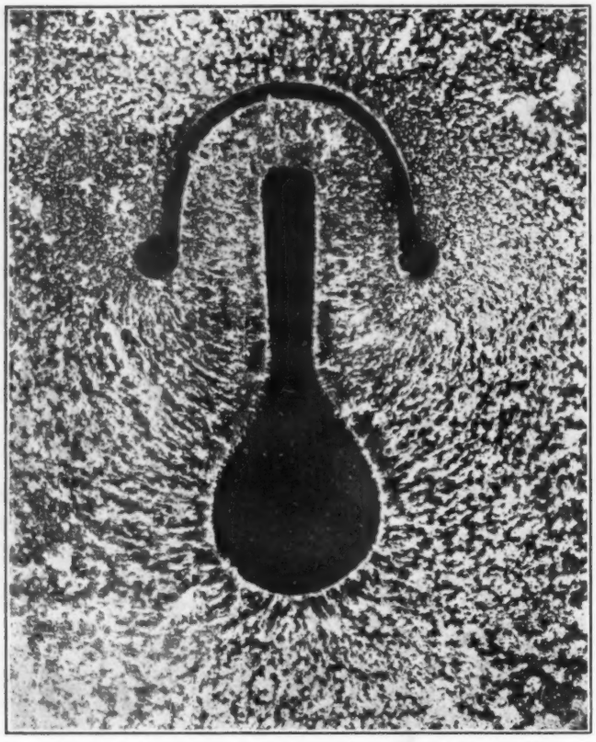
CONDENSER EQUIVALENT OF A STRING OF INSULATORS

On the other hand, the method showing individual



POTENTIAL GRADIENT CAN BE ALTERED IN SEVERAL WAYS

(a) Shows the effect of guard rings, (b) of various types of insulators, (c) of composite strings containing high-capacity disks and (d) indicates overcorrection.



THE DIELECTRIC FIELD FORM OF THE CAP-AND-PIN HARDWARE FURNISHES A BASIS FOR DESIGN OF THE PORCELAIN INSULATING MEDIUM

stress represents the conditions in the porcelain. In long strings we may find the line unit may be under a stress two to three times the average and more than four to six times the least stress. Part of the units are being worked to a dangerous percentage of their flashover strength and others are assuming little duty. Addition of more units does not increase the flashover of the complete string proportionately.

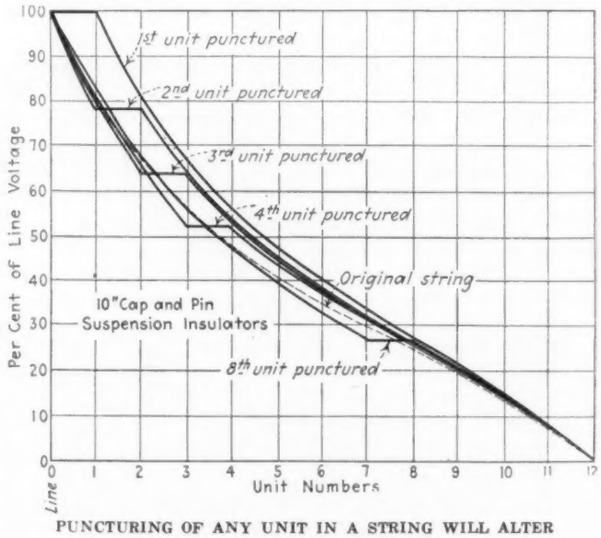
This condition of unequal stress is obviously far from ideal. To correct it requires a careful study of dielectrics and electrostatic fields. In an insulator string the real dielectric is air. The best dielectric condition imaginable would be to have the line hung in space below the tower with no material support. Provided that the shapes of terminals were correct, we should be able to approach the theoretical strength of air—30 kv./cm. When we put in a connecting body we change the conditions. We are still using air as a dielectric, but in parallel with or in contact with a solid surface. This at once reduces the available strength. The character of this surface and its shape limit the insulating values obtainable. Some years ago C. L. Fortescue* showed that forming of the electrodes to shapes which eliminate high points of stress and molding of the dielectric to conform to the Faraday tubes of force between such electrodes permits the most efficient use of the surrounding air dielectric. As high as 30 kv. per inch has been obtained with these rationally designed parts. Under existing practices it is not easy to incorporate these principles entirely, but some attempt should be made to adopt them, since present designs of insulators in strings rarely give more than 12 kv. per inch, dry.

At some distance from a string the surrounding air assumes a potential along a certain characteristic gradient. If the gradient over the surface of the string is radically different, points of stress will be formed which are starting points for flashover failures. Where a considerable portion of the length of a string is metal hardware, the gradient is obviously a series of discontinuous portions, for every point of each group of hardware is at the same potential. This disturbs the external field.

The common method of judging the insulating value of an insulator is by its flashover value (dry and wet) under certain standard conditions. Quite as important, however, are the potential distribution along the string and the provisions for withstanding arcing, mechanical design and dirt collecting qualities. A string with good stress distribution and a certain flashover value would be preferable to a string with poor distribution but higher flashover. Unstable line conditions, surges and other causes would break down the weak points of the second string and cause progressive failure. If the most highly stressed unit spills over, the total stress is then imposed on the remainder and ultimate failure of the whole results. With a properly distributed stress, all parts tend to assume more equal load and the total permissible stress is higher.

Mechanical requirements have been met by two general types of units—the cap-and-pin and the interlinked. In both porcelain is used under compression and the shapes of metal parts or electrodes are roughly limited. Of course, corners and sharp curves should be avoided as much as possible. As far as possible the main body of the dielectric should be made to conform to the shape of the tubes of electrostatic force and rain sheds should conform to the equipotential surfaces.

The field surrounding some of the present forms of suspension units has been studied and found quite instructive. The shape of the fields was determined by means of shredded asbestos sprinkled in the field with potential applied. Study of the accompanying diagrams



PUNCTURING OF ANY UNIT IN A STRING WILL ALTER THE POTENTIAL GRADIENT OVER THE STRING

will indicate how difficult it is to obtain surfaces which conform to proper lines and yet are reasonable from other standpoints.

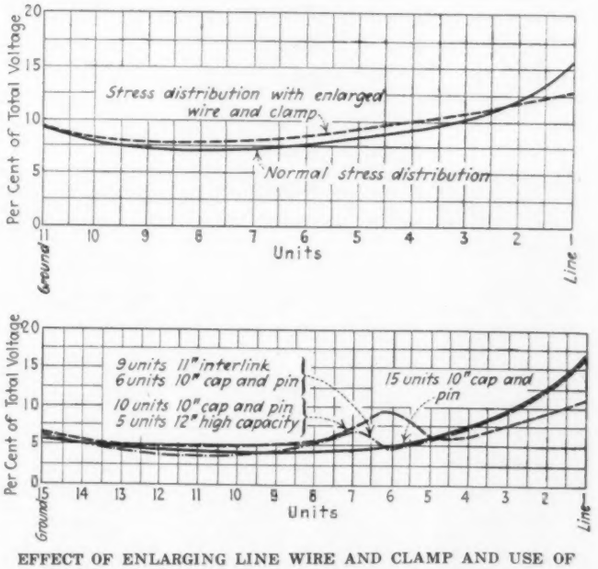
To correct the non-uniform gradient produced with ordinary strings of insulators three general methods have been employed: (a) External shielding and dis-

*A. I. E. E. Transactions, 1913.

tributing devices; (b) variation in capacity of individual units by addition of metal parts, and (c) variation in capacity of individual units by change in design. Each of these methods has several modifications. A more uniform field and better gradient can be produced by guard rings on the top and bottom of the string or even on the bottom alone. They increase the capacity and impose a field which has less concentration of stress. They also provide a path for the arc so that the porcelain is cleared during flashover. Vertical or horizontal cylinders supported at some distance from the string have been tried with considerable improvement. Combinations of special disks with rings and other forms produce the same result, and in fact the means of correction of this type are large in number. Enlargement of the line wire in the vicinity of the string and remodeled hardware help distribute stress considerably and reduce corona. For very high voltages it will probably be necessary to adopt this last expedient regardless of use of shielding devices. These devices, of course, must not be confused with arcing horns and rings which are provided purposely to provide points of high stress and consequent weakness. They lower the flashover but furnish an easy discharge path so that the porcelain disks are protected.

An investigation of guard rings for a string of 12 cap-and-pin units with 6-in. spacing developed interesting facts. Variation of size and number of rings as well as position allows change of the gradient from the original condition where line stress is the greatest to a condition where the ground units are under greatest stress or any intermediate stage. With the string used the best practical combination found was a combination of two 24-in. rings of 1-in. diameter material, one in the plane of the line wire and one 6 in. above—approximately even with the base of the cap of the second unit.

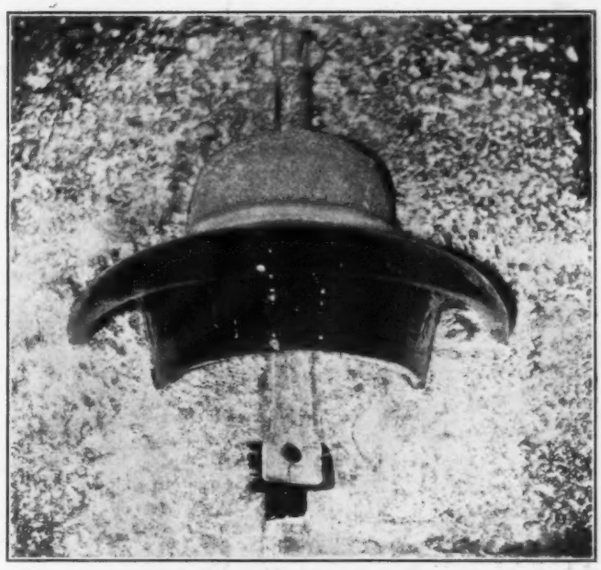
All these external devices present problems other


Per Cent of Total Voltage
Stress distribution with enlarged wire and clamp
Normal stress distribution
Units
Ground
Line
9 units 11" interlink
6 units 10" cap and pin
10 units 10" cap and pin
5 units 12" high capacity
15 units 10" cap and pin

EFFECT OF ENLARGING LINE WIRE AND CLAMP AND USE OF DIFFERENT TYPE INSULATORS ON STRESS DISTRIBUTION

than electrical which are serious enough to discourage their use to any extent at present. These forms are expensive to build, hard to apply and add an element of uncertainty in maintenance with which operating engineers are reluctant to contend.

Several years ago potential gradient was improved by



A UNIT DESIGNED FOR HIGH INTERNAL CAPACITY HAS FLUX LINES THAT TURN CORNERS ABRUPTLY

coating a portion of the top or under side of each unit with metallic paint or attaching metal disks. This added metal was varied in amount along the string, with the greatest amount at the line end. As would be expected, a very fine distribution was obtained. This method of grading units is open to criticism on the basis of complexity and trouble in replacement. It involves a large number of different units. Furthermore, corona is liable to occur at the edge of metal surfaces.

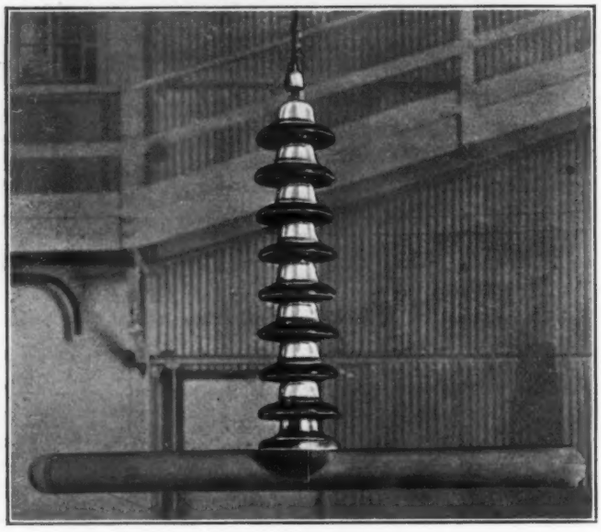
Probably the greatest hope lies in proper design of individual units to improve the field. Two courses are open—one to build a string of units of two or more designs, and the other to mask out the effect of capacity to ground by increasing the internal capacity of each unit. A combination of both is also possible. The former gives rise to composite or mixed strings composed either of similar units of different size or of different types of units. Strings have been proposed using cap-and-pin type units of 12-in. diameter at the line end and 10-in. units for the remainder. Some engineers have even gone so far as to use three sizes, 12-in., 10-in. and 6-in. or 8-in. disks. Such a string gives a commendable improvement, but the results obtained hardly justify the effort. Operating men criticise it because it involves the stocking of several sizes of units, involving a danger that the wrong size may be applied in renewals. A preferable method, which to some degree removes the objection just noted, is to use composite strings of unlike units. Interlinked units together with cap-and-pin units offer possibilities, as has already been shown.† The cap-and-pin units, being of much greater internal capacity, should be placed on the lower third of the string, and the remainder at ground end may be interlinked units. The unequal net capacities and stress on each unit are thus corrected. Under certain conditions the improvement experienced leaves much to be desired. The capacity of the interlinked units which must compose the major portion of the string is so low that the effects of capacity to ground and to one another destroy part of the value obtained.

Units have been designed with inherent high capacity

†F. G. Baum, *A. I. E. E. Transactions*, August, 1921.

which accomplish the results desired in a very satisfactory manner. Such a unit, with large-area metal parts, gives a gradient unshielded that is far superior to anything attained before. The maximum stress is reduced several per cent. This improvement warrants the higher expense of the unit, which can be made to incorporate other valuable properties such as increased mechanical strength, conformation to true electrostatic field and easily cleaned surfaces.

Especially important is the adaptability of a high-capacity unit to composite strings. A combination of



ENLARGEMENT OF THE LINE WIRE OR USE OF SHIELD RINGS IMPROVES STRESS DISTRIBUTION AND REDUCES CORONA

high-capacity units and cap-and-pin units, each being one step higher than the previously used interlink and cap-and-pin combination, gives remarkable results. In strings of eight units the lowest three of which are of the high-capacity type an almost perfect gradient is possible without a shielding device of any kind. In strings of fifteen units five of which are high-capacity a great improvement over cap and string is obtained. The maximum stress is reduced from 17 per cent down to 11 per cent of line potential. To demonstrate that correction can be carried to any desired degree by choosing units of proper capacity, a composite string of two interlinks, two cap-and-pin and three special high-capacity units was made up. Tests on it showed over-correction of the potential gradient, the greatest stress being thrown on the ground end.

Objection has previously been raised to use of mixed strings because of the discontinuity of the curve of gradient at the junction of the two types. This offers a point at which the air-potential gradient outside the string is widely at variance with the string potential. During surges or other special conditions a concentration of stress is thus allowed which invites flashover to this point and from there over the rest of the string. The characteristic flashover known as cascading results. Mixing of cap-and-pin units and units of higher internal capacity, which has been tried, has not given this trouble, and the discontinuity in the curve is not so great as with previous combinations.

When for any reason an insulator in a string is punctured, a change in distribution of stress takes place. The punctured unit cannot in all cases be considered short-circuited, for the charging current to remainder of the string may be insufficient to make a completely conducting path. Megger tests of punctured units sometimes fail to detect the failure, whereas the unit would not withstand flashover. In such a case the stress distribution has been found to be practically the same as it was originally. However, continued stress on the defective unit or moisture entering the puncture path will usually cause the unit to become a complete conductor eventually. The surprising feature of this change in distribution of stress is the smallness of the effect.

String	Actual Flashover (Dry), Kv.	Estimated‡ Flashover (Dry), Kv.
a	487	489
b	497	475
c	457	447

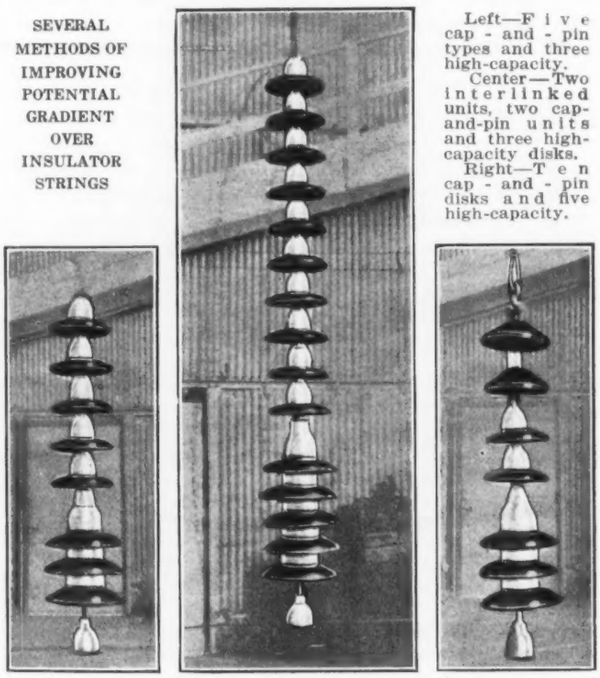
‡The discrepancies noted may be accounted for by makeshift connectors, but the general result is quite gratifying.

Analyzed critically, it will be discovered that puncture of any of the first few units at the line end produces a slight increase in stress at that end. Puncture of a unit near the middle produces no effect at the ends of the string and only a slight discontinuity in the middle. This discontinuity may offer a point of weakness, in some cases leading to overstress of other units and flashover of the string.

There has been some question as to the effect on flashover voltage value of mixing types of insulators. Experiments were made on three strings composed as follows: (a) Five cap-and-pin and three high-capacity; (b) two interlink, two cap-and-pin and three high-capacity; (c) six cap-and-pin and one high-capacity. The results are given in the above table.

In comparing flashover voltage of composite strings with flashover of uniform strings, the inherent differences in flashover voltages must be taken into account.

SEVERAL METHODS OF IMPROVING POTENTIAL GRADIENT OVER INSULATOR STRINGS



Left—Five cap-and-pin types and three high-capacity.
Center—Two interlinked units, two cap-and-pin units and three high-capacity disks.
Right—Ten cap-and-pin disks and five high-capacity.

The flashover value of "interlinks" per unit with 7-in. spacing is the highest; that of cap-and-pin units with 5½-in. spacing is less, and that of high-capacity units with the 4-in. spacing is least. Thus the flashover of each section must be weighted.

Technical Section for Broader Thinking

Chairman Schuchardt Points Out the Aims of the Technical Section of the National Electric Light Association — Emphasizes Benefits to Member Companies and Their Men

DEVELOPMENT of technical men in the central-station field to think of problems in their economic and public relations aspects as well as those of a technical character is declared to be the most important job of the Technical Section of the National Electric Light Association. To this end the work of the section can be effective only as all the technical men in the industry become interested in some form of technical committee work. The geographic division organization as an integral part of the organization is an important means to this end. Chairman Schuchardt emphasized these features of the section work before the Technical Section executive committee meeting at Madison, Wis., in July. They are again emphasized in this interview with a representative of the *Electrical World*.

DISCUSSING the activities of the Technical Section of the National Electric Light Association R. F. Schuchardt, chairman of the section, reiterated to a representative of the *Electrical World* the thoughts that formed the keynote of his opening address at the recent executive committee meeting of the section at Madison, Wis. Mr. Schuchardt said:

"The fundamental consideration on which the Technical Section of the National Electric Light Association is based is that of the association itself—service to the industry. A geographic division organization is provided as an integral part of the national technical organization to handle the division and local problems, so that the national committees can devote their efforts to improving and extending their work on problems of broad national interest. With the local problems are intertwined the problems of national scope. The division organizations should be able to present effectively data and local viewpoints to the national committees because of their intimate touch with their territory. Based on the work of the division committees and such independent activities as will be undertaken, the result of the technical committee work should be more far reaching than it has ever been. Information presented in the past through the yearly reports has been of great value to central-station men in general.

Personal Contact Brings Benefit

"However, the men who have been able to participate in the activities of the technical committees have been the recipients of even more benefit because of the personal contact with other men in similar work but with different conditions and problems and new, fresh viewpoints. Unavoidable conditions, the limitations of membership, and the distances involved in traveling, have kept down the number of men who could enjoy these benefits in the national committee activities. It is impossible to remove these limitations unless some supplementary organization is provided which will maintain intimate touch with the national technical committees and at the same time avoid the limitations imposed by distance. The geographic divisions provide this organization, and the technical committees in these divisions should be composed of all the men in the division who can possibly be interested in the work of any particular committee. The leaders of these committees should be the active members of the national technical committees and act as the ties between the division and national work. In some sections of the country, and perhaps in all, there are problems that are chiefly of state interest, and committees of state organizations for handling such matters are already formed or will be as future problems develop. Although the questions may at any particular moment have the appearance of local interest only, it is probable that most, if not all, of them will eventually become of national interest. For this reason the men who are active in the state or local committee movements should be the active members of the geographic division committees.

"If the work of the central station in its association technical affairs can be carried out as indicated, the result will be a development of personnel that will be invaluable to the industry. The most valuable man in any organization is the one who has the widest possible touch with the things in his field and who, because of that knowledge, can find or indicate solutions of everyday problems with the least possible delay or floundering about in experimental work. A wide contact with progress cannot be had by the man who has his nose to the grindstone of routine every day in the year. In an educational way much can be done by study of the technical literature that is constantly appearing, but this has its limitations. Personal contact with the men in the same field who are facing the same type of problems is the finishing touch needed to prevent the tendency to fall into a rut which is almost unavoidable on the part of the man who is held in an unvarying routine the year around. If the individual can be brought into contact, for a few days of the year, with other men doing similar work under different conditions, he soon learns of many methods of solving problems. He is provided with an incentive to study and to better himself. He is also led to supplement his personal contact with the men he has met by correspondence.

Discussion Develops Interest

"Discussions of problems in this way are a source of real profit to the individuals and lead to greater personal interest in the development of the industry and also to a knowledge of what is happening that inspires men to fuller investigation of subjects before decisions are reached. Many times snap judgment leading to serious error is prevented. In addition to the broadening influence of such contacts, the man who is wide awake and makes the most of his opportunities will acquire specific information on improved methods with which operating economies can be made in his own job more than sufficient to pay the expense of participation

in committee work, leaving the gain in the value to the man himself and to his company as a clear profit.

"The biggest and most important phase of the technical section work, however, is concerned with the relation of the technical man to economic and public relations matters. The engineer has been charged with confining his attention to purely technical matters and ignoring the important human relations and economic side of his problems. While some of the committees of the Technical Section are concerned with purely technical problems, others are handling matters that are founded on technical work but which in their most important phases are primarily economic and public relations problems. In a broad sense, the Technical Section is the common ground on which the technical, economic and public relations phases of the industry meet. Here the engineer is brought face to face with economic questions—matters of business policy in which executives, who must make the final decisions, depend on advice as to technical affairs from the engineers; questions of public relations in which the executives are similarly dependent upon technical advice, and all the various problems that face the industry. These problems are so completely interwoven with technical affairs that it is impossible to tell where one begins and the other ends. As a result the Technical Section is dealing, not with intricate research problems in which primary engineering principles and the highest type of pure science are the sole considerations, but with the problems of fitting these engineering principles and attainments of scientific men into practice in the workaday world.

"Perhaps the charge that the engineer has ignored practical affairs has had some foundation in past practice. It should have no foundation in future practice. So far as the member companies of the National Electric Light Association are concerned, the Technical Session is one of the principal agencies through which the engineer is being educated to consider his problems in the light of economics and human relations. He is brought into contact with the thinking on all phases of the problems before the committees because those problems cannot be segregated into purely technical and business matters.

Most Important Technical Section Work

"In the final analysis the development of such thinking is the real fundamental job of the Technical Section. The road to successful accomplishment of the job lies in the direction of the active participation of every technical man in any company organization in some form of local or state technical committee activity. The most active of these men and the outstanding leaders should make up the geographic division technical committees, and in turn the national technical committees should be made up mainly of the outstanding leaders and the most active members of the division committees. In this way the entire technical force of the member companies will be knit together for effective work. This is the condition needed as contrasted with the present condition of benefits to comparatively few. The opportunities are now within easy reach of all. Acceptance of these golden opportunities will serve as an incalculable aid in the effort to advance the electrical industry and make ourselves better American citizens. Development of men to broader thinking and better work is the most important aim of the Technical Section."

Record Output During June

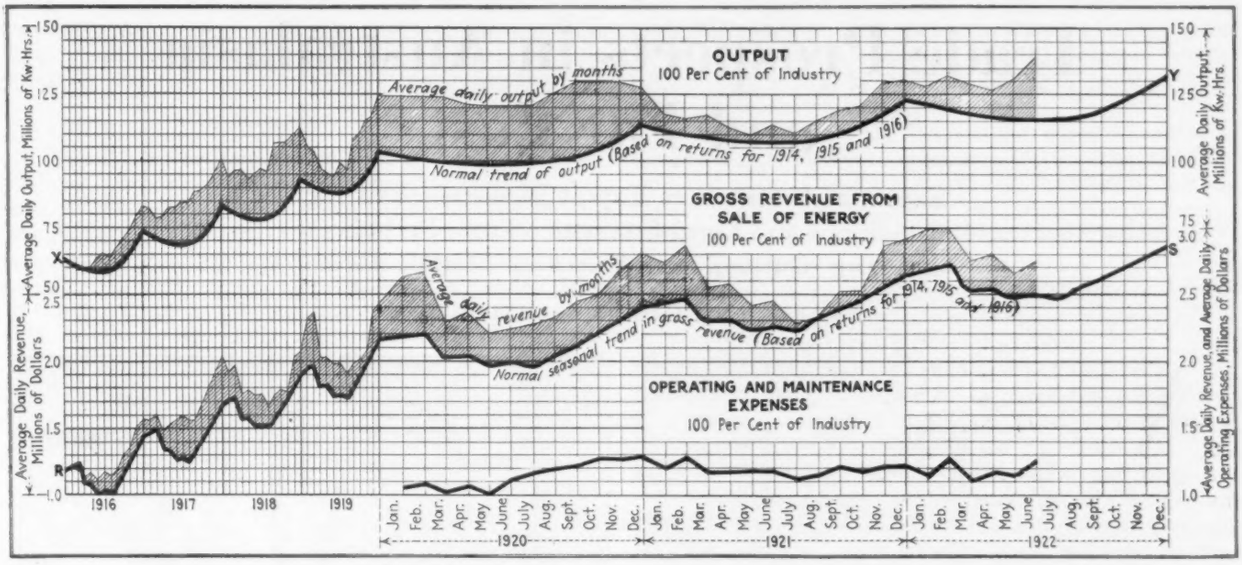
TWO new records for output were hung up by the electric light and power industry during June. Reports for the month received by the *Electrical World* from central generating and distributing companies representing 83 per cent of the installed generator rating of the country indicate that the average daily output was 138,793,000 kw.-hr., which exceeded the previous record, made during February, by 6,073,000 kw.-hr. In addition, the total output for the month of June was 4,163,000,000 kw.-hr., which exceeded the former high monthly figure set during May by 89,000,000 kw.-hr. and the output reported for June, 1921, by 21.1 per cent.

The significant fact about this new record is that it was made during a month which is normally expected to report close to the lowest operations of the year. But this cannot be considered a normal year for the electric light and power industry. It is estimated that 1,231,000 domestic lighting customers will have been added to the central-station lines by the end of the present year, and it is probable that 75 per cent of this new load has been taken on during the first half of the year. This new lighting load has undoubtedly more than overcome the decrease in lighting requirements which would be expected during a normal spring and summer.

Moreover, a falling off in industrial energy requirements would normally be expected owing to seasonal slackening, and this year there were added the effects of the long-continued coal strike and the uncertainty connected with the railroad difficulty. In spite of these adverse conditions, however, the government reports indicate that only one of the primary industries which are the largest consumers of electrical energy was operating under the May capacity. The record electrical energy output for June is, therefore, attributed to the

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)				Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase			1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
														1922	1921	1922	1921	1922	1921
Apr...	82	3,121,346	2,769,100	12.7	75	62,784	58,484	7.4	Apr..	61	21,402	21,657	—1.2	48.3	53.9	25.3	27.6	34.8	47.7
May..	83	3,381,598	2,804,660	20.5	76	62,401	57,791	8.0	May.	62	22,775	22,385	1.7	53.7	58.1	25.1	22.4	43.3	46.0
June..	83	3,455,994	2,854,042	21.1	76	62,939	56,724	10.9	June.	62	23,532	22,479	4.6	54.2	56.9	26.4	28.1	44.9	48.5


OUTPUT
100 Per Cent of Industry
Average daily output by months
Normal trend of output (Based on returns for 1914, 1915 and 1916)
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily revenue by months
Normal seasonal trend in gross revenue (Based on returns for 1914, 1915 and 1916)
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Revenue, Millions of Dollars
Average Daily Output, Millions of Kw.-Hrs.
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1916
1917
1918
1919
1920
1921
1922

combined effects of materially increased lighting and industrial energy requirements.

The total output of the central generating and distributing companies for the first six months of this year was 23,787,000,000 kw.-hr., as against 20,700,000,000 kw.-hr. during a similar period for 1921. Taking into consideration the curve of normal seasonal trend and the industrial conditions of the country, there appears to be little doubt that the total ouput for 1922 will exceed fifty billion kilowatt-hours.

During the first half of this year the total gross revenue from the sale of energy was $511,200,000, against $472,700,000 for a similar period during 1921. It appears, therefore, that the total gross revenue for 1922 will be considerably over one billion dollars.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, gives evidence of the material increase in the low-revenue load as compared with the high-revenue or lighting load during the first half of the year. In June the operating ratio of companies having steam electric generating plants only, taken in the aggregate, was 54.2 per cent, as against 45.7 per cent in January of this year.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
Apr.	81	232,294	205,100	13.2	82	1,129,200	979,666	15.3	80	1,019,170	910,482	11.9	63	158,524	137,240	15.5	94	582,400	536,612	8.5
May	82	241,879	200,030	20.1	83	1,207,565	984,646	22.5	82	1,108,082	935,268	18.5	62	166,171	138,576	19.9	95	657,901	546,140	20.4
June	82	243,664	200,343	22.6	83	1,197,576	981,045	22.1	82	1,165,272	961,886	21.1	62	166,400	139,100	19.6	95	683,082	571,668	19.4
REVENUE:																				
Apr.	81	$6,132	$5,808	5.6	76	$23,809	$21,847	9.0	67	$19,534	$18,017	8.4	62	$4,123	$3,928	5.0	94	$9,186	$8,880	3.5
May	82	5,787	5,508	5.1	76	22,596	21,203	6.6	69	20,239	18,175	11.4	62	4,131	3,782	9.2	95	9,648	9,123	5.8
June	82	5,788	5,428	6.6	76	22,394	20,421	9.6	68	20,603	18,200	13.2	61	4,114	3,798	8.3	95	10,040	8,877	13.1
OPERATING EXPENSES:																				
Apr.	53	$1,626	$1,650	−1.5	56	$7,322	$7,295	0.3	53	$7,142	$7,255	−1.6	61	$2,063	$2,075	−0.5	93	$3,249	$3,382	−3.9
May	53	1,617	1,692	−4.4	57	7,550	7,398	2.1	55	8,369	7,848	6.7	61	1,866	2,043	−8.6	93	3,373	3,404	−0.9
June	53	1,754	1,857	−5.6	57	7,699	7,368	4.4	55	8,525	7,870	8.3	61	2,152	2,032	5.9	94	3,350	3,407	−1.7

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
Steam Plants:																				
April	49.5	62.5	57.5	66.5	47.3	51.5	50.7	56.7	48.7	55.2	52.3	61.9	50.6	54.7	50.0	56.0	47.4	54.5	48.4	55.0
May	58.8	62.4	57.1	66.0	54.4	58.0	50.6	56.6	50.6	58.8	61.5	52.0	54.1	56.1	50.1	55.1	54.7	56.3	48.8	55.3
June	56.5	66.3	56.8	65.2	54.8	56.6	50.4	56.3	54.8	56.8	51.9	60.4	52.2	54.5	49.9	55.7	46.6	54.2	48.3	55.0
Hydro Plants:																				
April	38.4	37.0	33.1	44.1	21.0	24.5	18.5	22.8	23.6	24.3	22.6	22.1	37.2	22.4	36.0	34.2	27.5	31.7	26.9	26.4
May	32.0	28.7	33.2	42.1	16.2	18.0	18.5	22.7	22.1	22.7	22.3	22.6	33.0	28.0	36.4	34.4	35.2	32.8	27.2	26.8
June	36.5	37.0	33.8	43.0	26.9	26.1	19.9	23.4	21.3	20.5	22.6	22.4	32.0	27.3	36.5	34.8	25.1	20.0	29.6	26.1
Combined Systems of Steam and Hydro Plants:																				
April	43.7	45.9	52.6	52.4	47.7	50.6	45.1	49.7	47.8	52.7	46.9	55.8	39.8	43.7	43.5	45.1	33.7	38.2	36.8	41.0
May	46.2	49.4	52.4	52.5	44.8	45.3	45.4	49.5	50.6	55.1	47.7	55.8	38.5	44.5	43.1	45.3	31.3	34.4	36.6	40.7
June	48.8	58.7	51.9	52.0	48.7	51.0	45.8	49.8	51.4	53.7	48.3	55.2	43.7	49.3	43.0	45.8	31.9	38.0	35.8	40.0

Trade Prospects in Australasia and Far East

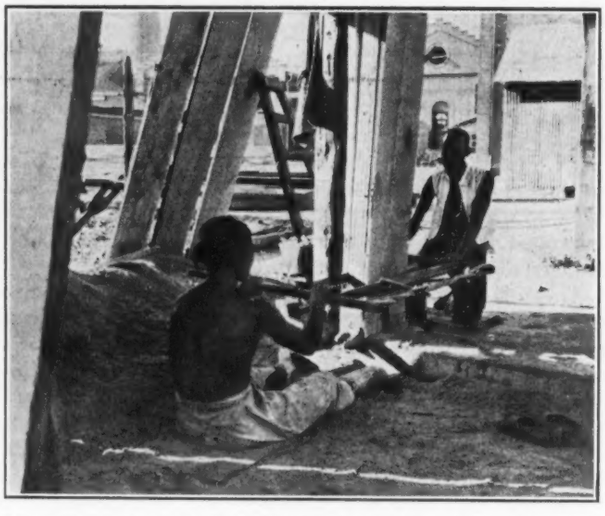
Extent of the Present Export Business—Existing Conditions and Local Products—Trade Prejudices and the Outlook for American Manufacturers

By P. S. SMITH and R. A. LUNDQUIST*

AUSTRALASIA and the Far East with their growing industrial development offer a steadily increasing market for electrical goods. It must not be underestimated and misjudged owing to the fact that the standard of living in India and China, for instance, is on the average very low. India with 330,000,000 people and China with approximately the same number make a total close to 700,000,000 whose purchases in the aggregate must be of immense volume, even if the per capita expenditure per annum is small.

As an indication of the extent of the growth in the use of electricity, the exports of electrical goods from the United States to some of the more important of these countries during the years 1913 and 1921 are significant. They are shown in the accompanying table.

The classes of electrical goods that can be sold in the various countries of the Far East and Australasia vary considerably with the particular market. This is readily apparent when one considers the relative developments in the countries, their natural resources and the social and industrial conditions existing in each.



POWER METHODS IN INDIA ARE STILL PRIMITIVE AND THERE IS GREAT NEED FOR THE ELECTRIC MOTOR. THE ACTIVE DEMAND IS GROWING

JAPAN PROGRESSING FAST

In Japan industrial production was greatly accelerated under the pressure of war-time demands, and wonderful progress was made in the development of the abundant water-power resources and in the distribution of electricity to all parts of the Island Empire. Yet Japan, in spite of its own extensive electrical manufacturing industry, is still a good field for heavy apparatus, switches and high-voltage items and for certain specialties. For very comprehensive plans have been developed by the Japanese government for progressive electrification of the government railways.

Japan offers small opportunity, however, for the sale of wiring devices or wire. The minor electric appliances that are in best demand are meters, electric ranges and small heating devices, electrical supplies for automobiles and carbons. Much telephone equipment and some cable is still sold in Japan from time to time, but on the whole it is confined to things that

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EXPORTS FROM THE UNITED STATES TO FAR EAST AND AUSTRALASIA

	Japan		China†		India		Australia		New Zealand	
	1913*	1921	1913*	1921	1913*	1921	1913*	1921	1913*	1921
Batteries	.....	$71,652	.....	$77,273	.....	$83,513	.....	$185,156	.....	$171,928
Carbons	.....	52,782	.....	2,365	.....	280	.....	2,539	.....	58
Generators	$848,357	1,755,041	$7,641	564,896	$2,655	376,651	$117,527	327,449	$1,548	123,698
Fans	10,474	16,100	34,006	141,165	36,965	433,473	6,211	21,480	37	930
Heating and cooking appliances	.....	91,337	.....	36,060	.....	14,709	.....	110,336	.....	59,986
Insulated wire and cable	.....	109,571	.....	442,290	.....	286,292	.....	156,086	.....	162,983
Wiring supplies and fixtures	.....	35,853	.....	77,907	.....	22,154	.....	121,415	.....	29,838
Lamps (electric)	4,783	1,845	7,084	73,073	2,135	26,354	41,688	267,264	3,975	62,766
Magnetos and spark plugs	.....	49,805	.....	20,859	.....	39,995	.....	77,446	.....	20,623
Meters and measuring instruments	.....	536,779	.....	161,989	.....	20,951	.....	306,275	.....	81,494
Motors	399,393	1,654,504	25,350	786,282	105,453	988,375	264,449	2,373,722	7,845	329,454
Rheostats and controllers	.....	235,659	.....	9,151	.....	35,872	.....	135,156	.....	17,491
Switches and accessories	.....	328,385	.....	388,484	.....	79,979	.....	242,458	.....	34,454
Telegraphic apparatus, including wireless	5,178	59,523	.....	9,318	19	27	7,826	12,855	1,433	4,576
Telephones	30,407	233,289	9,815	125,671	136	120,252	5,394	620,020	5,900	149,627
Transformers	.....	1,082,485	.....	737,355	.....	251,356	.....	1,017,080	.....	264,272
All other	1,067,246	3,384,526	86,629	993,660	317,266	906,055	671,730	1,556,704	195,990	412,335
Totals	$2,365,838	$9,699,126	$170,525	$4,647,798	$464,632	$3,686,288	$1,114,875	$7,533,441	$216,728	$1,926,513

* Fiscal year. † Includes Hongkong.

have a special application. The telephones in Japan are controlled by the government, and with the extensive local manufacture of this class of goods there will be in the future less opportunity for outside products.

OUTLOOK IN CHINA

China is an uncertain export field for electrical materials at the present time, but opportunities are constantly being presented. Electric lighting stations and telephone exchanges are found in most of the more important cities, but there are only a few towns in the country that have as yet sufficient load to require units of large capacity, and for some years the equipment will be mostly in units under 500 kw. to 1,000 kw. rating. Moreover, owing to the economic conditions, service must be rendered as cheaply as possible and wiring materials must be simple and inexpensive in order to meet the needs. Contracts for complete systems are generally awarded to some European firm in Shanghai, Hongkong or some other large city, and in such cases it is the practice of the builder to install all possible equipment of some particular type over which he has selling control and for which he can get the renewal and extension business. But when such control is not in effect the tendency is to use the cheapest possible materials, and in many instances Japanese and German wiring supplies will meet the requirements.

However, China can be regarded as a great potential market for American exports. Standards of living are rising steadily, and the return of young Chinese engineers who have been educated in the United States results in a constantly increasing call for high-class American equipment with which they have become familiar while in this country.

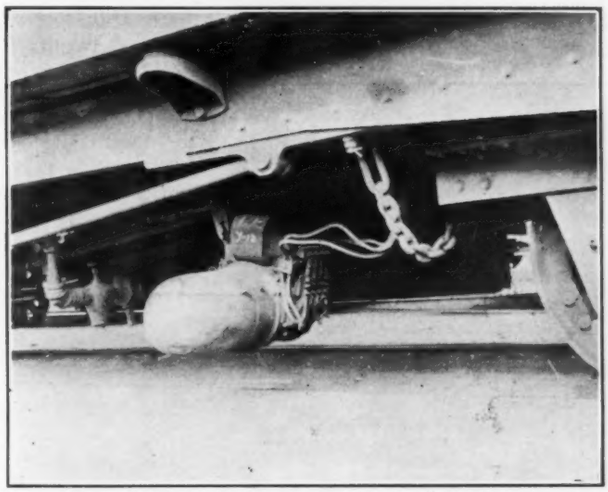
INDIA PROMISES MUCH

India is further advanced electrically than China in many ways, but here the American manufacturers are confronted by the lack of selling facilities and by the fact that a considerable number of the more im-

FAN MOTOR SHOP OF THE SHIBOURA ENGINEERING WORKS, JAPAN

portant existing central stations are more or less linked to British manufacturers. There are seventy-five jute mills and 284 cotton spinning and weaving mills, in addition to a large number of other industries where electric power is being steadily introduced. These plants are generally of considerable magnitude and install prime movers of large capacity. British capital predominates, but there is some American investment in the jute plants and considerable native ownership of cotton mills, so that in this field buying is less restricted than in the central-station field.

On the east coast of India steam-power plants are popular since the coal resources of the country are centered about Calcutta. On the west coast, centering about Bombay, water-power resources have brought about hydro-electric developments of considerable mag-



STONE TRAIN LIGHTING SET IN USE IN AUSTRALIA, NEW ZEALAND AND OTHER BRITISH COLONIES

nitude. Further water-power sites are under development at the present time, and it is likely that several new installations of large capacity will be made within the next few years. American manufacturers have been very successful in the past in bidding on water-power equipment, and their recognized superiority in high-voltage equipment places them in very good position for much of the large hydro-electric business which is contemplated.

India offers only a limited field, however, for the sale of American wiring devices because of the fact that English standards prevail and British methods are more or less required. Nevertheless, there is a good demand for certain American electrical appliances. The electric fan is probably the most widely sold, and this is purchased in all grades, types and sizes. Electric irons, grills and toasters also have a sale in moderate volume, with ranges and radiators coming rapidly into popularity in certain favorable sections. India undoubtedly is a very good potential field for American manufacturers, and efficient local representatives should be engaged in order to open up the market.

AUSTRALIAN MARKET

In Australia water power is found in the island state of Tasmania, but there are only a few feasible sites of importance on the mainland, although very good coal deposits exist. Strong urban concentration offers opportunity for the sale of a few large prime-mover units, mainly steam-turbine sets, and Australia is a good field for high-tension, moderate-voltage and distribution-type transformers, the latter being of large capacities, since the tendency is to concentrate distribution transformer capacity more than is common in the United States. In the high-tension field generally

American transformers, switchboards, switchgear, insulators, protective devices and line wire take a considerable portion of the business offered, and it may be expected that this will continue in reasonable volume. The growing industrial activity has resulted in a steady increase in motor installations, and since alternating-current service is largely employed, American induction motors in small and moderate capacities can be and are imported. The tendency is toward standardization at 50 cycles, with four-wire, three-phase distribution.

Very important telephone extensions are planned by the Australian government, and the high standing of American manufacturers in Australia should result in a fair portion of this business going to the United States. The tendency appears to be toward the installation of full automatic systems.

PUMPING IN THE "PADDY" (RICE) FIELDS OF CHINA WILL SOME DAY PRODUCE AN EXTENSIVE MARKET—AND CENTRAL STATIONS ARE ALREADY REACHING OUT FOR IT

In wiring supply lines, British standards being quite commonly used, there is only a fair market for the usual American fittings. Snap switches and screw-base sockets of standard American types, however, have a fair sale, though tumbler switches and bayonet sockets are predominant. Rigid conduit and American conduit fittings are not used to any extent, British standards for this class of material prevailing. The restrictions against any wire which is not the actual product of a member of the Cable Makers' Association of England are so severe as practically to keep American rubber-covered wire off the market, at least for the time being. Our standard wire cannot meet the megohm test called for by the underwriters in Australia, and this is a feature which also handicaps it in other British colonies.

All the usual domestic appliances which find favor in the United States will sell in Australia, with the exception of washing machines and electric mangles, and if backed up by persistent missionary work these eventually should find a limited market. In heating-appliance lines American products have always had a very good name in Australia and have always been able to meet the competition.

NEW ZEALAND STRONGLY BRITISH

New Zealand is well provided with central-station systems, and the expansion there will probably take the form of a broader use of electricity by the people. The available water power is being systematically developed and a federal superpower scheme is rapidly taking form.

Opportunities for American manufacturers exist in connection with the high-voltage network of the national hydro-electric developments, but the New Zealand government's policy is to place all possible business in England. In wiring supplies the tendency is to adhere even more closely to English standards than is the case in Australia, and standard American products do not have the opportunity for sale that they have in the latter country.

Domestic appliance lines, such as flatirons, kettles, toasters and grills, sell well in New Zealand, though possibly not in the volume that might be expected in view of the prosperity of the people. The power motors called for will be largely of moderate capacity since people depend more upon pastoral and agricultural resources than upon industry.

LOCAL MANUFACTURING

Japan and Australia are the only countries that manufacture electrical goods to any appreciable extent, although China has begun to enter the field. In Japan all classes of goods are made, but the reliability of the native product, especially in the case of high-voltage and large-capacity apparatus, has not been sufficiently assured to result in the domination of their home market by local manufacturers. Steam turbines, waterwheels, motors, generators, wire and wiring devices, lamps and telephone materials are all produced there in considerable quantity and on the whole are of fair quality. Some little export business to India, Africa, Australia and the Dutch East Indies has also been done in wiring devices, flashlamps and other articles of secondary importance.

In Australia some apparatus has been made for a number of years and certain minor wiring supplies and fixtures are produced, but the volume is small and industrial conditions and local problems are such that no extensive manufacturing is justified at the present, nor are the domestic manufacturers able as yet, as a rule, to produce such high-class equipment as can be imported.

In order to estimate the effect of local manufacture in these countries, it is interesting to note that Japan is at present the only one with any appreciable output of electrical goods, and that although that country has been manufacturing for some years, it is still one of the most consistent markets for American goods.

The scope of this paper will not permit more than the briefest mention of Far East countries other than those specifically noted. Java, Indo-China, Malaysia, Siam and the Philippine Islands, however, all offer markets of growing importance to electrical manufacturers and should be carefully investigated. Some lines of American types will not appeal, but there are many of our standard lines which should have a good sale.

Responsibility for Telephone Circuits

Supreme Court of Washington State Holds that Telephone Company Cannot Recover from Power Company the Cost of Metallicizing Ground-Return Circuits Against Superior Right Based on Prior Occupancy

THE finding of the Washington State Supreme Court in the inductive-interference suit noted in the *Electrical World* for Aug. 12, page 345, by which judgment awarding damages of $1,400 was reversed and the case remanded to the Superior Court with directions to dismiss the action forms an important precedent in the legal status of the ground-return telephone circuit. The case came before the Supreme Court on appeal by the Pacific Power & Light Company, which operates an extensive transmission system in central Washington extending on the west from Yakima to a point on the east about 60 miles to the north and east of Walla Walla, with the operating control point of the system at Pasco. In 1917 the company constructed a 66-kv. transmission line from Pasco to Lind by way of Kahlotus which tied into the system of the Washington Water Power Company. The line supports are cedar poles, and because of the rough nature of the territory many double-pole or H structures were used and spans up to and in some cases longer than 1,000 ft. were employed. The design of the line was carried out very carefully, and the circuit was balanced by transposing so that properly constructed telephone circuits that came into the territory later could be co-ordinated with it. Except for rural telephone lines there were no telephone circuits in the territory, the lines involved in the court action being of the class that belong under this designation. Nearly all the telephone circuits were ground-return, and as the cheapest and best method of constructing crossings complying with the state law the telephone circuits were carried underground at the crossing spans in iron conduit.

TELEPHONE COMPANY CLAIMS DAMAGE

The specific case concerned the Connell-Kahlotus Telephone Company. Circuits belonging to this company paralleled by the power circuit north of Kahlotus and on the highway were rebuilt and metallicized for a distance of approximately 8 miles, and repeating coils were put in the ground-return branches connecting with the line on the highway. A section of the telephone line immediately north of Kahlotus which occupied a position on a section line was removed to a location along a highway about half a mile east of the original location and rebuilt as a ground-return circuit for a distance of about 2 miles measured along the new location. This section was connected to the metallicized section through repeating coils. As a result of the work done to put the power line in the best possible condition there was no claim that the power line was not constructed, operated or maintained in accordance with the best standards of modern engineering practice, but the telephone company asked damages to cover the cost of metallicizing other circuits and for the loss of profits.

The jury in the lower court returned a verdict in favor of the telephone company in the sums of $900 for metallicizing circuits and $500 for the loss of profits. A motion to direct the jury to return a verdict against the plea of the telephone company was denied and, as already stated, the case went to the Supreme Court on appeal. The power company contended that it was on the highway by reason of a franchise properly granted and was under no obligation to bear any part of the cost of modernizing the telephone system to prevent inductive effects. The telephone company contended that because the power line interfered with the use of the telephones the power company should bear the cost of metallicizing, the prior occupancy of the highway by the telephone circuits being cited as giving the telephone company a superior right. The important parts of the decision are as follows:

"The testimony shows that the electric field created by the power line in this case extended for 1,000 ft. to one mile on either side thereof. The induction from the power line to the telephone line in no manner injured any property of the telephone company but only interfered with its use. When the power line was not energized the telephone could be used, the buzzing noise not being present. There was no way that the power line could have been constructed, operated, or maintained which would prevent interference by induction.

"The controlling question, then, is whether the power company was under obligation to bear such cost [that of metallicizing the telephone circuit]. This question is one of first impression in this court. It should be remembered in considering the question that the telephone company did not own the land through which with its single-line system the current returned to the point of origin. The weight of authority so far as the question has been determined is in favor of non-liability of the power company.

"In Lake Shore & Michigan Southern Railway Company vs. Chicago, Lake Shore & South Bend Railway Company (92 N. E. 989) were involved the conflicting claims of two transportation companies each operating on its own right-of-way. In that case the plaintiff was operating a steam railroad through a portion of the State of Indiana. In connection with the operation of the railroad it used a system of electric telegraph lines and signals necessary to its operation. The defendant was engaged in constructing on its private right-of-way adjacent and paralleling its road an electric railway between the towns of Gary and South Bend, a portion of which had been constructed and was in operation. The company's cars were operated by an electric system known as 'single-phase alternating current.' By reason of the proximity and parallelism of the two lines the high-tension circuit used by the defendant interfered with the maintenance and use by the plaintiff of its system of electric telegraph lines and signals, the current there as here passing from the defendant's line to the plaintiff's by induction. It was held that the operation of the defendant's line would not be interfered with at the suit of the plaintiff. In the course of the opinion it was said:

"'This controversy is between users of electricity,

appellant using light currents and comparatively delicate instruments, which are interrupted by escaping currents from the wires carrying exceedingly high voltage belonging to the appellee. It is not a question between one engaged in the ordinary development of his land and the customary and appropriate employment of it according to its inherent qualities and its surroundings, without bringing upon it artificialty of any substance not naturally found there (Evans vs. Reading, etc., Company, 160 Pac. 209, 28 At. 702; Pennsylvania Coal Company vs. Sanderson, 113 Pac. 126, 6 At. 453, 57 Am. St. Rep. 445), and one engaged in the unnatural and extraordinary use of his property, calling for the application of the maxim *Sic utere tuo*, etc., which is the governing principle in Fletcher vs. Rylands and Rylands vs. Fletcher (L. R. 3 H. L. 330). In this case the use of electricity is common to both parties, and both are acting under legislative grants. In such cases it seems to be the consensus of opinion, both in England and in this country, that where one is acting under legislative authority, and within the right thus given, and reasonably within the exercise thereof, using care and caution regarding the rights of his neighbor, any inconvenience or incidental damage that may arise in the absence of any negligence from the reasonable use of his own property will be regarded as within the rule *damnum absque injuria.*

QUOTES SOUTH AFRICAN CASE

"A like result was arrived at in the case of Eastern and South African Telegraph Company vs. Cape Town Tramway Companies (2 British Ruling Cases, 114), decided by the House of Lords of England on appeal from the Supreme Court of the Cape of Good Hope. In that case an action was brought by the telegraph company against the tramway company for damages for disturbance of the telegraph line caused by the working of the tramway and for the cost of appliances to prevent such interference. The interference there as here was caused by induction, and it was held that the tramway company was not liable, and in affirming the case it was said:

" 'Certainly there is here no injury of the same genus or species with the tangible and sensible injuries which have hitherto founded liability on the principle in question and which have always constituted some interference with the ordinary use of property. Now the kind and degree of interference with the respondents' property is pretty well illustrated by the fact that it can only take place if the cable is constructed without certain precautions, for, given the cable as it now is, there is no injury. This is referred to, not because their Lordships consider that the respondents have made out that the twin cable had the general use and recognition which they ascribed to it, but as showing that it cannot be predicated of the electric escape in question that it is destructive of telegraphic communication generally, but only that it affects instruments made in a certain way. Now, if the instrument be taken as it was when the injury occurred, its nature is such that to insure its immunity from disturbance is a somewhat serious liability to cast on neighbors. To describe this as a delicate instrument might be inaccurate, if the term were used in relation to other electrical instruments of extreme sensibility. But in the present discussion this is not the true comparison at all.

" 'The true comparison is with things used in the ordinary enjoyment of property, and this instrument differs from such things in its peculiar liability to be affected by even minute currents of electricity. Now, having regard to the assumptions of the appellants' argument, it seems necessary to point out that the appellants, as licensees to lay their cable in the sea and as owners of the premises in Cape Town where the signals are received, cannot claim higher privileges than other owners of land and cannot create for themselves, by reason of the peculiarity of their trade apparatus, a higher right to limit the operations of their neighbors than belongs to ordinary owners of land who do not trade with telegraphic cables. If the apparatus of such concerns requires special protection against the operations of their neighbors, that must be found in legislation. The remedy at present invoked is an appeal to a common-law principle which applies to much more usual and less special conditions. *A man cannot increase the liabilities of his neighbor by applying his own property to special uses, whether for business or pleasure.*'

"In the case of the Dakota Central Telephone Company vs. Spink County Power Company (176 N. W. 143), the Supreme Court of South Dakota sustained the rule of liability by reason of the particular statute of that state, but indicated that if there had been no legislative direction either way the court would adopt the view that there was no liability.

"While the precise question has not been considered by many courts or text writers, we are inclined to adopt the rule of non-liability. The telephone company, in order to maintain its single-wire system, must make use of the earth in which it has no rights for the completion of its return circuit. It does not seem reasonable to hold that the duty was not upon it to standardize its line in a way that would prevent interference in accordance with good modern engineering practice, when to maintain a single line it must make use of something which it does not own.

SUPERIOR RIGHT ARGUED

"It is suggested that since the telephone company was first upon the highway it has a superior right, but this position cannot be sustained. The statute (Remington's 1915 Code, Section 5,612) provides that no exclusive franchise or privilege shall be granted. The authorities are against the rule of superior right based upon priority.

"The prior occupant, as stated in 'Joyce on Electric Law' (Vol. 1, Section 372-A), 'while it obtains no exclusive right to the occupation of the street, does acquire a right, which is in the nature of an exclusive one, to the continued occupation of the space occupied by its poles and wires, subject to the proper control by the state or municipal authorities, and this right must be recognized by the subsequent company in the construction of its line.' "

The entire decision indicates that utilities occupying highways do not acquire by reason of prior occupancy any rights over later comers that release them from the obligation to maintain their systems in a condition complying reasonably well with the standards of the art and that they cannot throw the expense of bringing systems up to such standards on the later comer. The case in question is especially clear-cut, since poor physical condition or improper design or construction on the part of the power company was not an element in the controversy, and the decision is thus rendered free from extraneous circumstances.

Underground Construction Suggestions

Material Specifications and Installation Requirements that Can Be Applied to Advantage Where Better or More Elaborate Standards Have Not Been Adopted

By WILLIAM SHERIFF JONES
Bureau of Yards and Docks, Washington, D. C.

MANY electric service companies and large industrial plants have developed their own standards of practice for installing underground circuits. Such companies the author does not presume to advise. But besides these there are many medium and small-sized plants that are leaving the form of construction and material specifications to their construction foremen, and these plants might, it is thought, benefit by applying some of the following standards. They are based on the practice of the United States Navy Department Bureau of Yards and Docks and have been found very effective under a variety of conditions.

Fiber Ducts Favored for Power Circuits

The designing engineer should give complete specifications for his material, and the engineer in charge of the installation should give definite instructions on all details, for the system is inherently expensive and every consideration of economy demands that it be put in correctly. Of the materials used the vitrified-clay duct and the fiber conduit are well known, and the engineer can do no more than see that his specifications are correct and that the proper kind of duct is used.

Specification for Vitrified-Clay Duct.—Vitrified-clay duct should be made of finely ground compact clay thoroughly vitrified and salt-glazed inside and out and free from stones and pebbles and iron, lime or other foreign substances injurious to the finished product. The conduits should, when practicable, be of the multiple-duct type, 3¼ in. inside and uniform in size and quality, with inner walls not less than 7/16 in. thick at any point and outer walls ⅝ in. thick. Ducts should show an average absorption of not more than 5 per cent when completely submerged for twenty-four hours in water at a temperature of 60 deg. to 80 deg. F. The outer walls should be scarified, or otherwise suitably roughened, for at least 2 in. at each end, and each section of multiple duct provided with at least two dowel-pin holes or other approved means for accurately centering duct holes at each end.

Specification for Fiber Conduit.—Fiber conduits should be of 3½-in. inside diameter with not less than ¼-in. wall and of the taper and sleeve-joint type. This conduit should be made of wood-pulp fiber, thoroughly impregnated with an insulating compound which will render it impervious to the action of salt water, and itself free from all substances which may corrode the lead sheath of a cable. The bore should be straight, the cross-section should not vary at any point more than ⅛ in. from a true circle, and the inner surface should be free from excess compound, flaky areas, dents or other obstructions as gaged by its ability to pass a 36-in. mandrel of ¼ in. less diameter than that of the conduit.

Fiber conduits have come into rather extensive use during the last ten years, and they have a distinct advantage in ease of transportation because of their light weight and high resistance to breakage. The weight of standard fiber conduit is only about 15 per cent of that of the equivalent in multiple terra-cotta duct. The lighter-weight fiber duct, with ⅛-in. wall, weighs less than 10 per cent. It has been found in some instances that with clay duct as much as 10 per cent of the quantity has been broken or destroyed on the way to the job. There is also more or less of this material broken in handling before it actually reaches its final resting place in the trench. Considerably less care is required in handling the fiber product, and there is practically no waste. These matters, as well as the difference in freight rates, should be taken into consideration in determining the relative costs of the two duct materials.

Fiber conduits are made up with several different types of joints, each suited to the particular condition of the installation. The tapered joint with sleeve is more generally used because it allows gradual changes in the direction of the line and permits curves of long radius for the purpose of avoiding obstructions. The thickness of wall of the standard fiber duct varies with the size of bore and type of joint, from ¼ in. to 7/16 in. It can readily be seen that the conduit having a threaded type of joint will require a thicker wall than that having a tapered joint.

Thin-Wall Type of Fiber Serves as Concrete Form

In the concrete structure shown by detail B on Fig. 1, a type of construction recommended for fiber-conduit installations, the wall thickness of the conduit need only be ⅛ in. to act as a form for the concrete. This structure provides a 1¼-in. concrete wall at its thinnest point between ducts. Construction of this character makes the entire conduit line a solid monolithic mass of concrete, the duct itself simply serving as a form. This type of construction is considered superior to terra-cotta, as shown by detail A, in that the concrete surrounding the duct offers more resistance to the heat of a flaming arc such as is frequently experienced in short circuits of high-power electric cables. Quite frequently several cables in adjacent ducts are damaged or destroyed by the failure of one cable. Using the thin-wall type of fiber duct eliminates in a measure the objection in regard to softening due to absorption of moisture, which reduces the duct bore. Should the fiber soften and swell with the thinner duct, it will not form an obstruction but may be forced out in particles when pulling in or withdrawing cables, thereby leaving the solid concrete walls.

Short Circuit of Cables Within Ducts.—It has been found that a sustained short circuit on low-voltage feeders in clay duct would communicate to all four ducts of the multiple at the joint, thereby destroying all of them at this point and usually melting the terra-cotta, copper and lead into a molten mass. This necessitates the digging up of a considerable length of duct line before the damaged cables can be removed and new ones installed. In the case of a cable fault of this character in the fiber-conduit construction as recommended it has been observed that only the fiber is destroyed, leaving the concrete intact, and no communication of the arc with the other ducts has been experienced. The cable may be readily withdrawn, the duct cleaned and new cable immediately pulled in.

Considerations in Deciding on Duct Material.—Telephone companies appear to favor the terra-cotta duct construction and in some instances use creosoted wood duct. Their cables, however, do not carry sufficient current, on short circuit or ground, to damage the duct. In determining the type of duct best suited to a particular installation, the following points should be given consideration: (a) Transportation; (b) amount of handling necessary before being laid; (c) purpose for which ducts will be used; (d) class of labor obtainable.

Separation of Telephone Ducts from Those for Light and Power.—Telephone companies as a rule require that there shall be a separation of at least 6 in. of concrete or 12 in. of dirt between their conduits and those carrying electric light or power cables. It has been found in practice that 3 in. of properly composed concrete will provide ample protection for signal or telephone cables, and this separation is recommended where the ducts for the two systems are to be placed in the same trench. It is considered extremely advisable to provide manholes for telephone systems entirely separate from those used for lighting and power cables.

LOCATING OBSTRUCTIONS BY TEST HOLES

Before starting the excavation of a trench for underground ducts test holes should be dug at proposed manhole locations to ascertain whether obstructions are to be encountered and to locate them exactly. Obstructions, such as buried gas mains and other underground pipes, which have not been taken into consideration, may require a redesign of the particular part of the system where such obstructions exist. It is frequently found advantageous to move the obstructions or, as is usually the case, to pay the owner to move them. Gas pipes or mains should never run through manholes, nor should piping of any character where it is possible to avoid it.

Curves.—The trench should be dug in as straight a line as practicable. It may be found desirable in avoiding obstructions or for other reasons to provide offsets or curves in the duct line, in which case the distance between manholes or pulling points should not exceed 250 ft. and the sum of the total curves should be not greater than a right angle. Curves should be made at a radius of not less than 25 ft., using regular or short lengths of conduit. It will be found in the case of terra-cotta ducts that lengths can be selected which have a slight curvature and therefore serve well for the purpose.

Depth of Duct Line.—Conduits should usually be laid so that the top of the duct structure will be from 24 in. to 36 in. below grade, depending considerably upon traffic conditions. In no case should conduits other than steel pipe be less than 18 in. below grade. The bottom of the trench should be graded not less than 3 in. in 100 ft. so that the conduit will drain from one manhole to the next or from the middle of the run toward both manholes. The bottom of the trench should be graded evenly, and where unnecessary excavation has been made below the bottom line of the trench it should be filled in with concrete and not the excavated material. Ducts entering and leaving a manhole should be as near as possible at the same level.

Obstructions Within Ducts.—Conduits should be carefully examined just before laying them to see that the inner surfaces are free from obstructions, projections and dirt and to see that the duct is otherwise perfect. The ends of ducts should always be plugged when leaving work for the day. Where the plugs are not especially treated so as to be waterproof, they should be thoroughly soaked in water and covered with wet cheesecloth. Untreated dry plugs are liable to swell, owing to the absorption of moisture from the ducts, thereby bursting or cracking the ends of conduits.

Where necessary to use short lengths of conduits, owing to the location of manholes, the short sections should not be placed directly at the entrance of the manhole, but further out in the line. In passing through rock soil a 3-in. layer of sand should be placed under the concrete bed supporting the ducts. The sand acts as a cushion and prevents damage to the conduit structure from earth shocks or vibrations. Joints of conduits should be staggered, both horizontally and vertically, and for clay ducts a thin layer of mortar should be placed between each tier. For fiber ducts, combs which will separate the ducts the proper distance should be used, only one tier being laid at a time. The sections of multiple clay duct should be secured in alignment by means of at least two dowel pins and the joints wrapped with strips of wet burlap or coarse muslin, plastered over with about ½-in. thickness of cement. The burlap or muslin strips should be not less than 9 in. wide and should overlap at the top by from 3 in. to 5 in.

As duct sections are laid a mandrel of ¼ in. less diameter than that of the duct should be pulled through them. This will give immediate indication of imperfect duct structure or misalignment and will smooth over any concrete which may ooze through at joints. The trench from one manhole to another should not be filled in until the ducts in this section have been completely laid and tested.

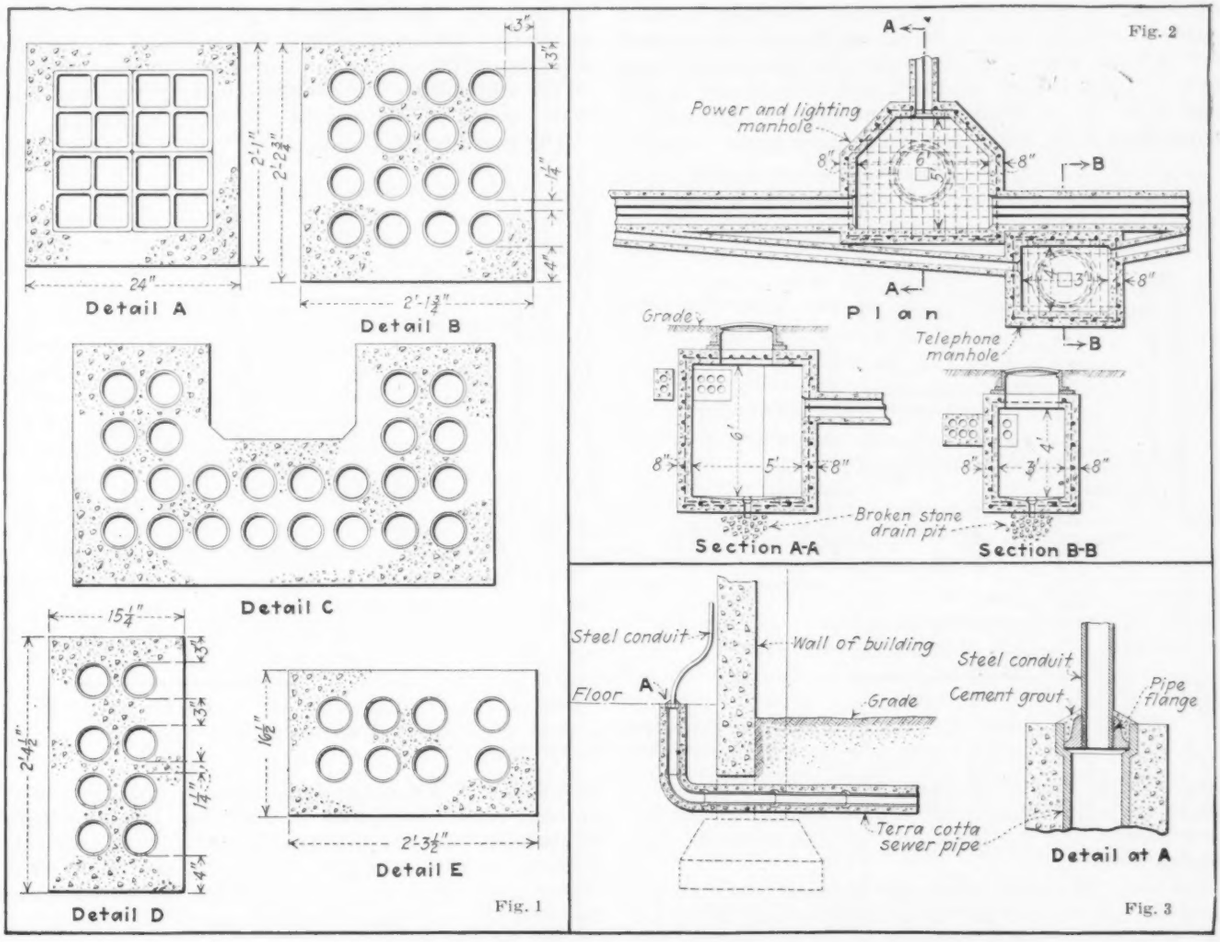
Although numerous arrangements have been proposed and are in use in providing concrete protection for ducts, it is thought that in these days of increasingly heavy traffic the factor of safety has in some instances been too low. In Fig. 1 are indicated various recommended duct structures. It will be noted that all of these structures have a complete concrete envelope.

It has been often noticed in plans covering underground distributing systems that duct sections are shown as narrow as 10 in. Where the soil conditions permit it is desirable from all standpoints to have the earth sides of the trench act as the concrete form, in which case such narrow duct sections are impossible, if they are to be laid to any depth. Detail D in Fig. 1 indicates a duct section 15¼ in. wide and 28½ in. deep. If we assume that a duct line of this section is to be placed, with top of structure 30 in. below grade, it will require a trench almost 5 ft. deep and only 15¼ in. wide. The designer of such a trench fails to take into

consideration the fact that men have to get down into the trench to lay the duct and that he has made this impracticable. Where the number of ducts is as indicated in this section the arrangement should be as shown by detail E, which requires a trench of sufficient width to permit efficient working and of less depth. It is therefore considerably cheaper to install.

Arrangement for Large Number of Ducts.—Detail C in Fig. 1 shows a proposed arrangement for a large number of ducts. With the usual formation the center and top ducts are subjected to the heat from cables in lower and adjacent ducts, and the carrying capacity of cables in these ducts is thereby greatly reduced. The not less than 48 in. Where it is impossible to obtain these depths, steel conduits should be used, but they should be avoided as far as possible because of their shorter life. The life of steel conduits may be considerably lengthened by galvanizing or coating with hot tar and embedding in concrete.

Duct Bore.—It has not been found economical to install main ducts of a smaller diameter than 3 in., and ducts as large as 4 in. inside diameter are coming more and more into favor among the larger duct-using companies. The additional cost of the larger ducts is very slight and may be represented as the difference in cost of the duct material alone.



FIGS. 1, 2 AND 3—DUCT-LINE, MANHOLE AND SINGLE-DUCT ENTRANCE CONSTRUCTION DETAILS

1—Formation, separation and protection of circuits. 2—Manhole arrangement for mixed telephone and light-power system. 3—Single-duct entrance to building using standard clay sewer pipe; steel conduit grouted into opening at floor level.

formation shown provides greater radiating surface and is recommended for consideration for that reason. In other cases where a large number of ducts are required it is found to be of sufficient advantage to separate the conduits into two parallel lines with separate concrete envelopes and in this manner to obtain the necessary radiating surface.

PRACTICE AT CROSSINGS

In crossing under street railways the top of the conduit structure should never be less than 24 in. below the bottom of the ties, and it is quite frequently found necessary to use reinforcement in the concrete envelope. In the case of steam railroads the depth should be

Trench-Digging Machines.—For the installation of a system involving any great amount of work the digging of trenches is now done with a special power-operated trenching machine. Most of these machines are adjustable as to the width of trench they will excavate, but the operation is considerably simplified if the duct sections are arranged with widths as uniform as practicable.

Split Ducts for Repair Work.—In making repairs to existing duct work where cables are already installed it becomes necessary to replace broken or defective ducts. For this work split-duct sections may be used so as to obviate the necessity for withdrawing cables which may be in service. Up to a short while ago it was the

practice to split the duct on the job. Ducts are now obtainable in split sections, which simplifies this class of work to a considerable extent.

Manhole for Mixed System.—Fig. 2 shows typical manhole details for a combined underground system for lighting and power and for telephone or signals, with separate manholes for the telephone or signal system, but with a common trench for the duct line. Manholes are usually constructed either of brick or concrete.

Brick Versus Concrete Manholes

In congested districts and at points where obstructions exist it is often found advisable to build manholes of brick. In excavating for brick manholes a clear space of not less than 4 in. should be provided beyond the outside walls. Brick walls for manholes should never be less than 8 in. thick, and they should be not less than 12 in. thick when the floor of manhole is more than 8 ft. below grade. A good grade of hard-burned brick should be used and wetted thoroughly before laying. Every fifth course should be bonded with headers and the brick laid up approximately nine courses in 2 ft.

Concrete Manholes.—Concrete manhole walls should never be less than 6 in. thick, and they should be not less than 8 in., unless suitably reinforced, where the floor depth below grade exceeds 8 ft. or the length of the manhole, inside, exceeds 9 ft. Forms for concrete manholes should be securely braced in position before pouring concrete. Forms should be cleaned and wetted just before pouring and the concrete placed evenly all around, rammed and puddled as it is being poured. This insures a more dense and therefore stronger structure and provides smoother walls. Forms should be left in place, after pouring is completed, for at least seven days, although the top frame may be placed and the refilling or paving done within twenty-four hours. Manhole roofs should always be reinforced.

Manhole Frames and Covers.—The manhole cover frame should be placed on a brick collar in order to provide an even bearing surface for it. Cover frames are usually of cast iron and are warped to a greater or less degree. The brick collar provides a ready means of raising the manhole frame and cover in case the grade of the street of roadway is raised—it being a comparatively simple matter to provide one or more additional courses to the brick collar. In the case of an installation where there is a future prospect of the surface grade being lowered it would be wise to provide a brick collar of several courses, which may be readily reduced in height when the actual grading takes place. In order to facilitate the pulling of cables, manhole openings should be centered with respect to the main line of ducts and eyebolts provided in the walls of manholes.

Manhole Shape and Capacity.—Some authorities have advocated building manholes of oval shape or with rounded corners to provide better for racking cables within them. This shape of manhole does not work out to the best advantages where transformers, oil switches or other equipment are to be provided, so that the shape of the manhole should be determined by the conditions under which it may possibly be used in service.

The capacity of a manhole or vault for transformer installation is not determined alone by the floor space or head room which may be available, but principally by the heat losses of the transformer and the radiating surface of the side walls and roof of the vault. For transformer capacities up to 200 kw. an allowance of 3½ cu.ft. of vault space for each kilowatt has been found to be good practice.

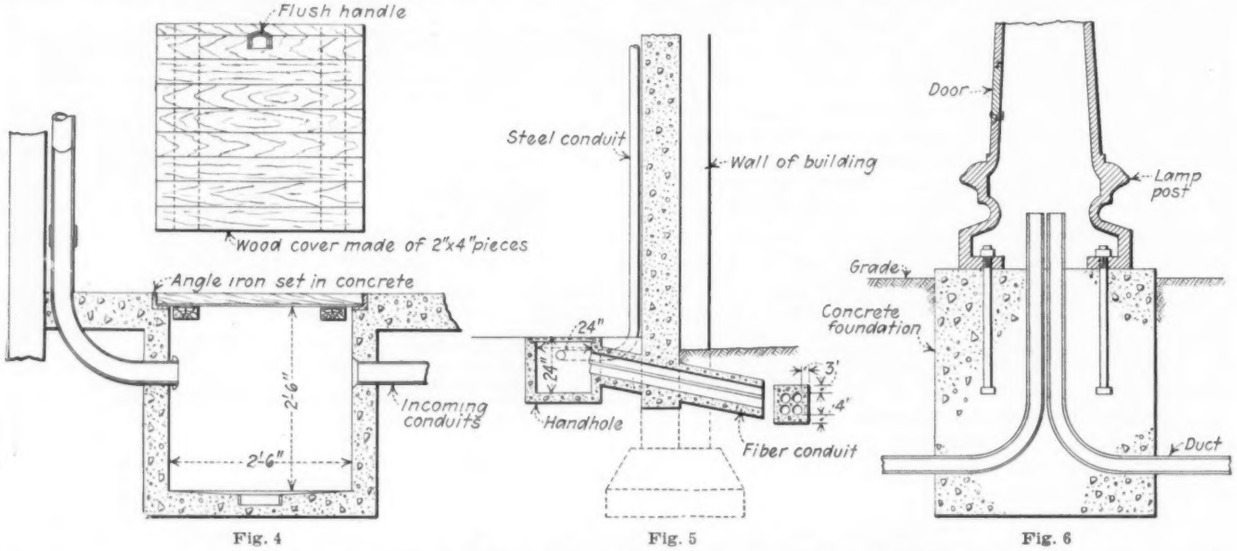


Fig. 4 Fig. 5 Fig. 6

FIGS. 4, 5 AND 6—HAND-HOLE FOR INTERIOR WORK, MULTIPLE-DUCT ENTRANCE AND STREET-LAMP CONDUIT CONSTRUCTION

Manholes Should Be Waterproof

Wherever possible manholes should be drained to a sewer system. Where this is not practicable and the manhole floor is below mean-high-water level the walls and floor should be waterproofed. Broken stone or sand pits are sometimes found satisfactory for draining manholes. A typical broken-stone drain is shown in Fig. 2. There are in use today several methods of waterproofing the walls and floor of concrete manholes, and this question is a topic of more or less discussion and difference of opinion. The methods to be used are as follows:

(a) By combining with the cement a weight of hydrate of lime equal to 10 per cent of the weight of the cement used.

(b) By coating the outside walls of the manhole with hot tar and laying the floor on tarred felt.

(c) By building sheets of tarred felt within the concrete structure.

The first method would be effective were it not for the fact that the concrete walls almost invariably crack, thereby permitting water to seep in from the outside. The second method depends upon the thoroughness with which the tar is applied and has in practice been found to become ineffective after several years. This method has the disadvantage of requiring the excavation to be sufficiently large to permit application of the tar on all four sides, and therefore, in addition to the large excavation, it requires an outside form. The third method, which is considered the most reliable, is, as is usually the case, the most expensive in that it requires two forming operations for each manhole. In the case of an 8-in. wall the first form is set to provide a wall approximately 3 in. thick. When this wall becomes hardened the form is removed and the tarred-felt sheets applied to all walls and the floor. Another form is then set to build the remaining wall and floor thicknesses.

Hand-Holes.—Pull-holes or hand-holes are essential to most systems of underground distribution. They are used where a pulling point is necessary or a tap is to be made and where a subway structure as large as a manhole is not required. Fig. 5 indicates a hand-hole at the entrance of multiple duct into a building. Fig. 3 shows how sewer pipe is generally used for single-duct entrance into a building. Fig. 4 represents a hand-hole proposed for use in connection with an underground system within a large shop building. It is considered that for the large distributing system hand-holes should not be too small, and it is recommended that where a regular size manhole is not required a smaller manhole such as is shown in Fig. 2 be provided. This will permit keeping the ducts at the proper depth.

Conduits at Street Lamp Post.—Fig. 6 shows a method of terminating conduits at lamp posts for street-lighting systems. With this arrangement, if the posts be not spaced too far apart, it is practicable to pull the cable directly from one post to the next, thus eliminating the necessity for pull-holes. The splices between cables and the post wires are made in the base of the lamp post.

Pulverized-Coal Systems in America

SYSTEMS for burning pulverized coal and experience therewith are both considered extensively in the revised edition of the (English) Fuel Research Board's Special Report No. 1 on "Pulverized Coal Systems in America." Among the subjects covered are operating conditions with pulverized fuel, notes on range of fuels suitable, cost of installation and cost of powdered coal, standard mill-house practice and tabulated answers given on questionnaire sheets sent to American users of pulverized coal, transportation of coal dust to burners, notes on pulverized coal storage and spontaneous combustion, feeders, mixers and burners, applications, opinions of users, working results, etc. The conclusions of the board are stated, and five appendices are included as follows: (1) Systems investigated in 1918 and new systems, (2) installations visited by the author in 1918, (3) pulverized-fuel users, (4) difficulties in the use of pulverized coal, and (5) bibliography.

Although this report was conducted by the Department of Scientific and Industrial Research, copies are obtainable from H. M. Stationery Office, Imperial House, Kingsway, London, W.C. 2.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Strength of Poles Determined by Their Taper

To the Editors of the Electrical World:

The writer noted with interest your editorial of June 10 regarding the relative importance of ground-line and top diameters of wooden poles. During some experiments* conducted by the writer at the Massachusetts Institute of Technology to determine the strength of telephone poles more than twenty full-sized poles were actually set in the ground and broken. In view of the data obtained from these experiments it is questioned whether it would not be more correct to state that the strength of a telephone pole is determined by its taper. The maximum stress on a pole of a given taper comes at a definite distance below the top irrespective of its length, provided this point of a maximum stress is at or above the ground line. If the taper is great enough, as in the case of most cedar poles, this point may be a considerable number of feet above the ground line, and the strength of the pole is proportionate to its top diameter. If the taper is small enough, this point of maximum stress may be at the ground line or below, and the strength of that pole is proportionate to the ground-line diameter.

LAURENCE S. WINCHESTER.

19 Milk Street, Boston, Mass.

Why a Lighting Code May Be Opposed

To the Editors of the Electrical World:

The editorial in the Aug. 12 issue of the *Electrical World* entitled "Unreasonable Opposition to Lighting Codes" appears likely to create a wrong impression of the reasons underlying the opposition to the Massachusetts Lighting Code originally proposed, to which the editorial obviously refers.

The majority of the opposition—in fact, all the specific opposition—came from electrical engineers of the industrial plants, men who are constantly in touch with practical illumination problems and who are bound by the ethics of their profession not to lend their support to an unworthy cause. Objections were not made on the ground of increased operating expenses, but from the standpoint of the great investment required if the code be literally interpreted.

The 15-degree cut-off from the horizontal provision of the proposed code for general lighting reflectors permitted only the use of one specific reflector of the drawn-steel type, namely the "RLM," which leaves much to be desired in the uniform distribution of light in the horizontal plane, especially with bowl-enameled lamps. Because of the fact that this "RLM" reflector is a comparatively recent development comparatively few of them exist in manufacturing plants today. A little development on the part of the reflector manufacturers should render this type obsolete.

Unfortunately, the only reflectors giving good light distribution are made of glass, which, reasonably, would not be considered suitable in many locations.

The 30-degree cut-off requirement for local lighting

*See *Electrical World*, March 16, 1911, page 667.

reflectors required the replacement of the cheap cone-shaped reflectors with 25-watt lamps, which are generally used below the level of the eye and often placed so they can be fixed in any position at the option of the workmen. If an illuminating engineer is willing to admit he can sometimes be wrong, it is generally possible where serious objection to general lighting is made to get the workmen's point of view in wanting his own little lamp.

Any reasonable interpretation of the uniform lighting requirements of the originally proposed code would have required a high intensity of general illumination in spite of the fact that local lights might have to be increased in size to overpower the general illumination.

It is the writer's experience that manufacturers are willing to spend money for lighting reflectors if they have any reasonable assurance that such expenditure will be of benefit to their employees. Such benefit would be sure to be reflected in increased production. Illumination, like medicine, is an abstract science, and the practice of either cannot be specifically covered by law.

Simonds Manufacturing Company, Fitchburg, Mass. R. G. CUSHING, Electrical Engineer.

A Patent Index Freak

To the Editors of the Electrical World:

This is to call your attention to a freak in indexing found in the "Annual Indexes of Patents," published by the United States Patent Office. In each volume at least as far back as 1913 a curious non-alphabetical sequence has been adopted, as follows: "Driers," "dry battery," "drying process," "drill," "drum," "dumping."

Any one interested in dry batteries, for instance, would naturally search for such entries between "drum" and "dumping," but would find nothing.

New York City. A. LAW VOGE.

Discussions at Conventions

To the Editors of the Electrical World:

I am interested in the editorial in the issue of the *Electrical World* for Aug. 12 under the caption "How Can Convention Discussions Be Stimulated?" This is a problem that the National Electric Light Association has considered for a long time past, and I believe that the present administration is in accord with the suggestion that efforts be made to create proper and constructive discussion at conventions and other meetings.

In my opinion the greatest aid to those in attendance at conventions and other group meetings is the interchange of ideas and knowledge on the different problems under consideration, and I think it is a fact that too often those with intimate and accurate knowledge on various subjects are apt to "hide their light under a bushel" and not impart their information by entering discussion on the floor of the convention. This attitude, I think, is not due to any selfish motive or to any lack of desire to impart the information, but in some cases to reticence or mistaken modesty and in other cases to the lack of opportunity for such discussion because of the limited time sometimes given to consideration of important subjects.

I think your editorial is timely and that much can be done for the good of the industry to improve this condition. The subject is one now under consideration by the N. E. L. A.

National Electric Light Association, New York City. FRANK W. SMITH, President.

Property Investment Versus Power Factor for Demand Billing

To the Editors of the Electrical World:

In the Aug. 12 issue of the *Electrical World* Prof. L. H. Rittenhouse of Haverford College objects to one of the conclusions drawn by the writers in their joint paper on "Kva. Basis Favored for Demand Billing," which appeared in the May 6 issue of the *Electrical World*.

The professor shows where the difference between the "property-investment" method and the "power-factor" method for computation of billing demand *may* be of much smaller magnitude than 23 per cent if the proper standard power factor is selected. This is true indeed, and, as Professor Rittenhouse shows, it may be made as low as 2 per cent when a standard power factor of 95 per cent is used in the same problem. By working the problem backward we can find that 93.4376 per cent gives exactly the same result as the property-investment method which is by definition the correct method to use for demand billing.

Professor Rittenhouse points out that "in obtaining the billing demand for the 'property-investment' method they [the writers] boost the units to be billed to 4,550 by the simple expedient of: $2,800 \times 100 \div 61 = 4,550$." The professor states further: "Naturally a larger bill will result, but it is not due to the application of the 'property-investment' method, but rather to the use of a 100 per cent standard power factor in place of the 75 per cent."

The professor uses the same billing problem and a 95 per cent standard power factor and gets a higher demand bill than the writers get with what their critic terms the simple expedient of using 100 per cent standard power factor; thus $2,800 \times 100 \div 61$ is less than $2,800 \times 95 \div 61$, which of course is untrue. The mathematics in both problems is equally precise, and therefore Professor Rittenhouse proves by his own example that he is wrong in the statement that he has made.

The example which the writers used was an actual case of billing, using the metered quantities and the rates in vogue. The professor will no doubt agree that in the specific case cited the return on 23 per cent of the investment serving the customer was lost. This example was used because many utilities have identical power-factor clauses incorporated in their rates for electric service.

That which Professor Rittenhouse terms as a gain in his conclusions is really an error. We must bear in mind that the loss in demand revenue is not a loss sustained by the utilities alone. The loss is an economic loss sustained by the utilities and the customers served. Most of the loss, however, is sustained by the customers. Public utility commissions fix the rate on the "cost of service" theory and allow a fair return on the investment.

Public utilities commissions do not allow discriminatory rates, and yet rates which have power-factor clauses not based on property investment are discriminatory in that they do not afford proper distribution of the demand charges.

The writers are indebted to Professor Rittenhouse for his discussion of the paper and wish to thank him for his courteous criticisms.

Union Gas & Electric Company, Cincinnati, Ohio J. E. DORAN, R. C. FRYER, J. B. HODTUM.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Production Expenses at Connors Creek

THE total production expense of the Connors Creek power station per kilowatt-hour of output for the twelve months ended June 30, 1922, has shown a decided decrease over the figure for the year ended Dec. 31, 1921, according to figures that are again available through the courtesy of Alex Dow, president and general manager of the Detroit Edison Company. Another notable change since the *Electrical World* last printed these figures (see issue for April 1, 1922, page 635) is the further increase in plant economy, the B.t.u. per kilowatt-hour being the lowest since the data have been printed in these columns. The figure—19,700 B.t.u. per pound of coal, a decrease of 6.7 per cent from the former low figure of 20,040 B.t.u. per pound of coal for the year ended June 30, 1917—is truly a remarkable one and is a credit to the operating force.

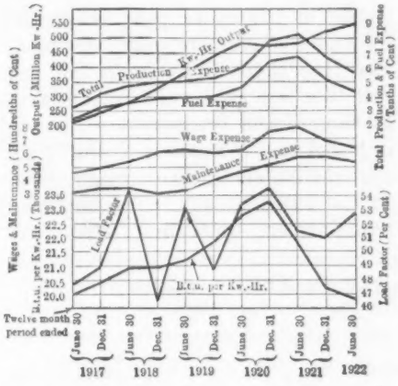


FIG. 1 — TENDENCIES IN PRODUCTION EXPENSES, ECONOMY AND LOAD FACTOR

In regard to the results in the past year Mr. Dow says:

"You will note that the coal per kilowatt-hour and the B.t.u. per kilowatt-hour are both down to a creditable figure, whch should be interpreted to signify that the coal supply during the twelve months has been satisfactory and that the boiler-room efficiency, as well as the turbine efficiency, is back to the pre-war standard—indeed, it appears to be a little better.

"Present disturbed conditions of coal supply, if they continue for any length of time, will spoil the showing of the next twelve months, although so far, because of the use since April inclusive of a large proportion of reserve coal, the disturbance of heat economy has not been very great. Costs, of course, will be increased by the present high prices of such coal as is purchasable. As the Connors Creek station has no economizers, they may have to be installed if prices stay up."

During the past twelve months both the average load and the yearly output have increased more than 5 per cent, the maximum demand increasing a little less than 2 per cent. While the peak period for operating and maintenance expenses per kilowatt-hour was in the year ended June, 1921, which showed an increase of 153 per cent over the figures for June, 1917, this year's figures are only about 75 per cent greater. Maintenance of steam equipment is still at a high level, but this is due largely to the undertaking of maintenance which was deferred previously because of high prices.

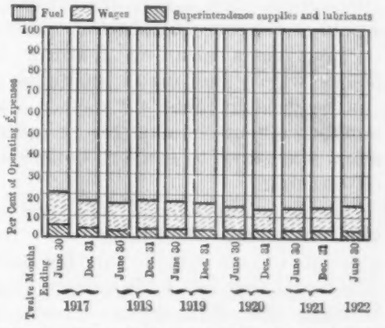


FIG. 2—RELATION BETWEEN FUEL, WAGES AND SUPERINTENDENCE

To afford a comparison of produc-

COMPARISON OF PRODUCTION EXPENSES PER KILOWATT-HOUR OF OUTPUT FOR CONNORS CREEK POWER HOUSE OF DETROIT EDISON COMPANY

	Twelve-Month Periods Ending										
	1917		1918		1919		1920		1921		1922
	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30
OPERATION:	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Superintendence	0.010	0.010	0.009	0.009	0.010	0.010	0.010	0.012	0.015	0.014	0.013
Wages	0.047	0.050	0.055	0.061	0.062	0.060	0.062	0.076	0.079	0.069	0.065
Fuel	0.240	0.325	0.368	0.382	0.394	0.407	0.471	0.652	0.682	0.532	0.438
Water	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lubricants	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.001
Station supplies and expense	0.005	0.005	0.006	0.009	0.010	0.007	0.011	0.012	0.010	0.010	0.010
Total	0.303	0.391	0.439	0.462	0.478	0.486	0.555	0.754	0.788	0.627	0.527
MAINTENANCE:											
Station buildings	0.011	0.010	0.008	0.007	0.008	0.011	0.010	0.011	0.012	0.011	0.012
Steam equipment	0.019	0.024	0.025	0.023	0.024	0.029	0.036	0.038	0.043	0.045	0.041
Electrical equipment	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.003	0.003	0.002	0.002
Total	0.031	0.035	0.035	0.031	0.033	0.041	0.047	0.052	0.058	0.058	0.055
Total production expense	0.334	0.426	0.474	0.493	0.511	0.527	0.602	0.806	0.846	0.685	0.582
Output in kw.-hr.	210,039,700	249,192,200	280,814,700	327,020,500	383,252,000	445,535,500	488,060,600	479,425,900	485,189,500	527,121,200	555,896,300
Maximum demand in kw. (30-minute)	50,000	58,000	59,000	80,000	82,000	104,000	104,000	100,000	107,500	118,000	120,000
Average load (kw.)	23,900	28,400	32,100	37,300	43,700	50,800	55,600	54,600	55,300	60,200	63,500
Load factor	0.478	0.489	0.544	0.466	0.533	0.488	0.534	0.546	0.515	0.510	0.529
Coal per kw.-hr. (lb.)	1.52	1.61	1.63	1.63	1.67	1.73	1.83	1.92	1.78	1.62	1.55
B.t.u. per kw.-hr.	20,040	20,470	20,930	20,900	21,200	21,800	22,800	23,300	21,800	20,250	19,700

tion expenses since 1917 the accompanying table is given. Fluctuations of the various items in the table and the present trend are given in Figs. 1 and 2. Production expenses, kilowatt-hour output, load factor and B.t.u. per kilowatt-hour are shown in Fig. 1, while the relation between fuel, wages and superintendence, etc., is given in Fig. 2.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Oil and Coal Mixture for Emergency Fuel

As an emergency fuel a mixture of fuel oil with fine coal in as large proportions as the coal will absorb and hold is suggested by the United States Bureau of Mines to steam coal users to augment their fuel supply during the present shortage. While under conditions of normal fuel supply such a mixture probably would not prove satisfactory unless it involved a cleaning feature, in places where fuel oil is available it can be used to piece out a poor coal supply without the changes in equipment necessary to convert boilers to oil burning.

The finer the size of coal used in this mixture, the larger is the amount of oil which will be held. Slack coal that has a high percentage through an eight-mesh screen or which may be crushed to sizes of ¼ in. or less will take up in oil from 30 per cent to 40 per cent of its own weight and make a fuel high in calorific value. Coarse slack coal, however, will absorb oil to only 3 per cent to 10 per cent of its own weight, which would give a fuel having 4 per cent to 15 per cent increased heating value. Tests made by the bureau at its Pittsburgh experiment station indicate that the mixture can be made with either bituminous slack or anthracite culm. Anthracite culm or dust which will sift through ordinary grate bars can be used successfully when mixed with the oil, as the oil causes it to adhere and the oil residue cokes as soon as heated.

Chain grates and certain other automatic stokers are usually well adapted to handle the oil-fuel mixture if the bin and feeding devices are suitable. The mixture will not fire spontaneously, but care should be exercised to ventilate bins where external heat may tend to drive off lighter gases, although most of the fuel oil which is on the market has had the lighter oils distilled from it. In using oil-coal mixtures the fire will smoke badly after firing or while breaking up the coke bed from time to time. The amount of testing that has been done in this work shows that careful firing is required to prevent continuous smoking. Experimenting must be done in each case to determine the best method of firing.

The method of mixing oil and coal bears a relationship to the Trent process of purifying coal by fine grinding and amalgamation with oil, now in operation at a plant at Alexandria, Va. This plant has demonstrated the success of a combination of oil and coal for steam making, gas manufacturing and other fuel purposes. The present emergency proposal does not contemplate the cleaning process, but involves merely the simple mixing by shovel or concrete mixer. The Trent Corporation has volunteered to assist in advising in the use or application of oil-coal mixtures and to waive during this emergency any claim of infringement of its process which may or may not be involved, without reference to cleaning.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Supplying and Metering Primary Power

IN MAKING all installations for primary-power customers the Depew & Lancaster (N. Y.) Light, Power & Conduit Company follows one standard type of construction. This reduces the time required to install the equipment and facilitates the quick checking of wiring and the making of tests. A typical design for a three-phase, 4,800-volt installation for loads of 25 kva. or larger is shown in Fig. 1. The figures in this drawing refer to the bill of material given in table form.

The pole on the left of the illustration is the receiving point of the 4,800-volt circuit upon which the fuse cut-outs are installed. The line continues to the other pole, where the lightning arresters are mounted. The line then drops from the first pole to a bus across the bottom arms as shown, and breakers are inserted in the *A* and *C* buses in front of and over the metering transformer shown at the extreme left. The metering transformer unit and customers'

BILL OF MATERIAL ACCOMPANYING DETAIL DRAWING OF 4,800-VOLT POWER INSTALLATION

Key	Quantity Required	Material	Furnished by Company	Furnished by Customer
1	2	Cedar or straight chestnut poles	1	1
2	10	Long-leaf yellow-pine cross-arms	2	8
3	60	1½-in. x 9-in. locust cross-arm pins	12	48
4	20	⅝-in. x 1¼-in. x 28-in. galvanized cross-arm braces	4	16
5	20	½-in. x 4-in. galvanized carriage bolts	4	16
6	2	½-in. x 5-in. galvanized through bolts	..	2
7	20	½-in. x 10-in. galvanized through bolts	..	20
8	2	½-in. x 14-in. galvanized through bolts	1	1
9	4	½-in. x 16-in. galvanized through bolts	..	4
10	2	½-in. x 18-in. galvanized through bolts	..	2
11	2	½-in. x 20-in. galvanized through bolts	..	2
12	4	½-in. x 16-in. galvanized spacing bolts	2	2
13	4	½-in. x 20-in. galvanized spacing bolts	..	4
14	10	½-in. x 4½-in. galvanized fetter drive lag screws	2	8
15	1	½-in. x 16-in. galvanized eye bolt	1	..
16	92	½-in. x 2-in. x 2-in. galvanized square washers	10	82
17	3 lb.	Sixpenny galvanized wire nails	..	3 lb.
18	52	1-in. No. 10 galvanized flat-head wood screws	6	46
19	4	4-in. No. 16 galvanized flat-head wood screws	4	..
20	8	No. 1001-04 Pierce galvanized cross-arm straps	..	8
21	8	No. 4401-01 Pierce galvanized clamp pins	..	8
22	6	No. 106 Pierce galvanized house brackets	..	6
23	2	No. 350 Pierce galvanized secondary racks	..	2
24	2	2½-in. x 5-in. strap hinges	..	2
25	1	8-in. hasp	..	1
26	2	Padlocks	1	1
27	9	4-in. galvanized pole steps	9	..
28	20	1¼-in. galvanized pipe straps	3	17
29	16 ft.	1-in. galvanized iron pipe	8 ft.	8 ft.
30	2	1-in. Shawmut ground clamps	1	1
31	1	Matthews cable clamps	1	..
32	3	4,800-volt No. 106,918 G.E. 100-amp. cut-outs	3	..
33	..	4,800-volt G.E. lightning arresters	..	..
34	31 ft.	Wood-ground wire molding	4 ft.	27 ft.
35	30	No. 44 Locke blue-white primary insulators	6	24
36	16	No. 44 Locke green secondary insulators	..	16
37	8	No. 355 Pierce rack insulators	..	8
38	2	Single wire porcelain cleats	2	..
39	2	Style No. 121,730 Westinghouse wood strain insulators	2	..
40	1	Concrete base	..	1
41	..	Power transformers	..	..
42	1	Packard polyphase metering transformer	1	..
43	..	T.B.W.P. stranded primary wire	..	..
44	..	T.B.W.P. stranded secondary wire	..	..
45	..	Five-wire metering cable	..	..
46	30 ft.	No. 4 T.B.W.P. solid wire, arrester ground	..	30 ft.
47	10 ft.	No. 4 T.B.W.P. solid wire, transformer ground	10 ft.	..
48	4	2-in. x 4-in. x 18-ft. common rough lumber	..	4
49	4	2-in. x 4-in. x 10-ft. common rough lumber	..	4
50	60	⅝-in. x 12-in. x 7-ft. common rough lumber	..	60
51	2	2-in. x 4-in. x 3-ft. common rough lumber	..	2
52	1	2-in. x 4-in. x 5-ft. common rough lumber	..	1
53	6	6-in. diameter x 10-ft. fence posts, butt-treated	..	6

NOTE: Items that cannot be found in Fig. 1 refer to material in other detail drawings not shown.

transformers are mounted on a concrete platform between the two poles.

Inside the case of the metering unit are two 4,000/100-volt potential transformers and two current transformers with a ratio of five to five. The method of tying the current transformers into the 4,800-volt circuit is clearly shown in the diagram. To each of the five primary leads brass tags are fastened stamped with the proper phase and polarity. For the secondary connections a terminal board with five copper strips is mounted inside the case. The secondary leads from the transformers are connected to these, using a point common to potential and current, and a stud from this connection runs through the case for the ground wire, which is on the opposite pole from the arrester ground. There is also a bushing provided at one side of the tank, through which is inserted a five-wire cable that goes to the meter panel. A definite color scheme is used for these wires.

The entire structure is designed to be flexible in its arrangement. The clearances of high-tension leads from surrounding objects and the necessity of placing the metering transformer unit as near as possible to the meter are the determining factors in locating the rest of the equipment. Whenever possible, the secondary buses should be on the side nearest the building to be served.

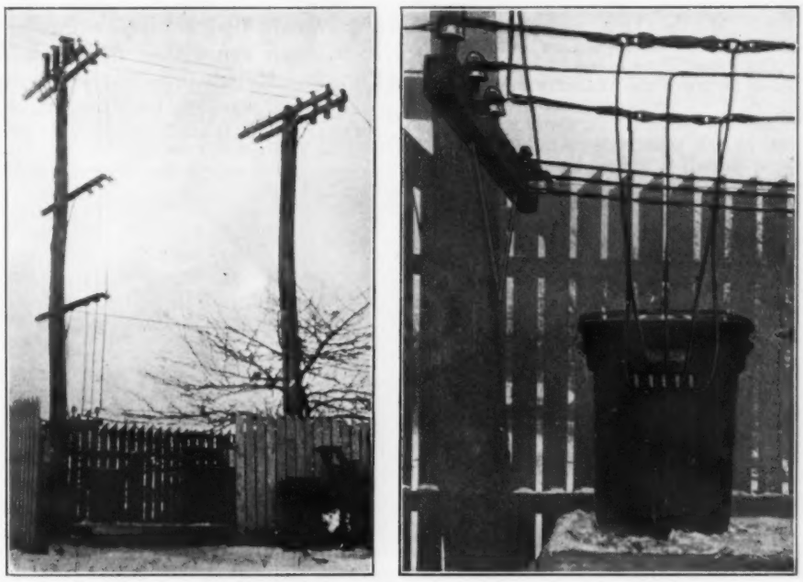


FIG. 2—ENTIRE METERING STRUCTURE DESIGNED TO BE FLEXIBLE

Instrument transformer (right) is located just to the right of the left-hand pole. The method of connecting this transformer to the primary circuit is shown in Fig. 1.

Some of the specific instructions to be followed in an installation of this kind, and which accompany these drawings are:

(1) The concrete foundation between the poles for the transformers should be designed and set in the ground to such a depth as to carry a distributed load of 5 tons.

(2) The cover bolts of each transformer are to be grounded to each other by means of a wire bent in a figure "8," and the three transformers, together with the metering transformer, are to be connected to the ground wire, as shown in Fig. 1.

(3) The neutral wire is to be run on the extreme end of the cross-arm so that when taken to the service rack it will be the top wire.

(4) Pins should be placed in all cross-arm holes, all unused pins being sawed off, except on the top arm, to prevent the arms from decaying.

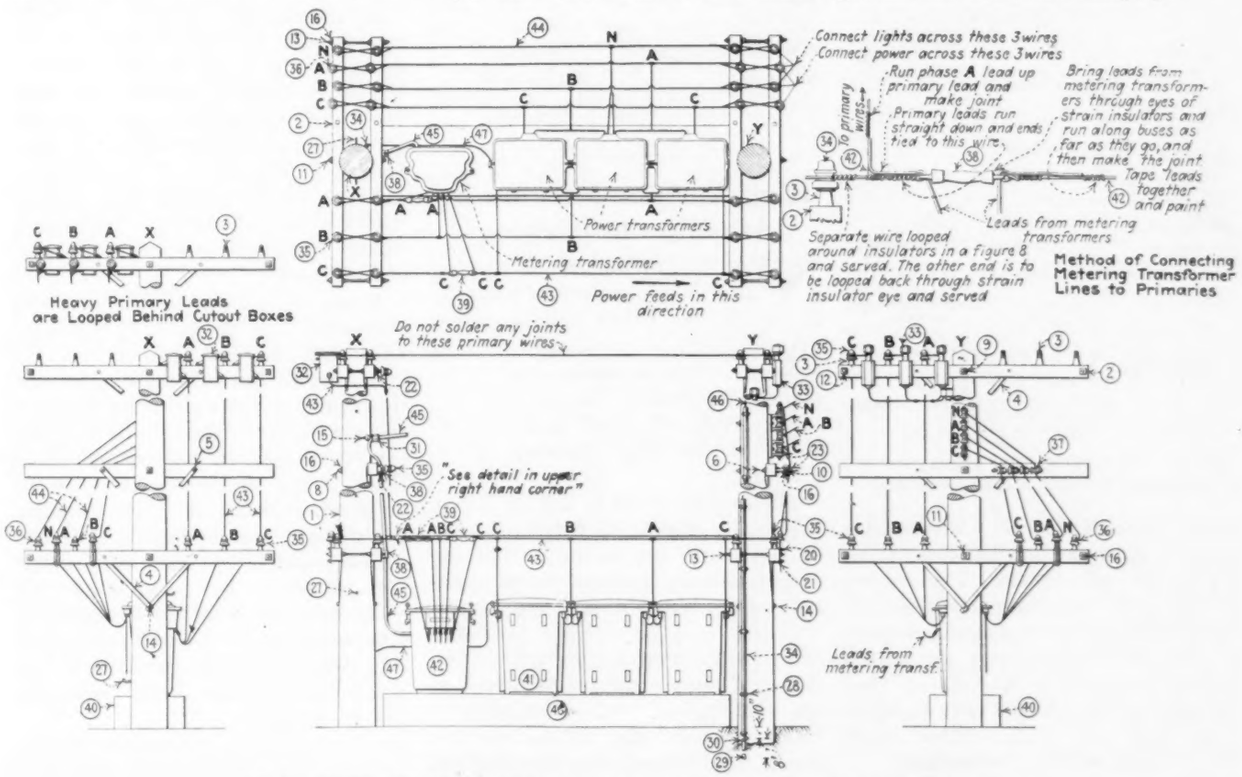

Connect lights across these 3 wires
Connect power across these 3 wires
Run phase A lead up primary lead and make joint
Primary leads run straight down and ends tied to this wire
Bring leads from metering transformers through eyes of strain insulators and run along buses as far as they go, and then make the joint
Tape leads together and paint
Leads from metering transformers
Power transformers
Metering transformer
Power feeds in this direction
Separate wire looped around insulators in a figure 8 and served. The other end is to be looped back through strain insulator eye and served
Method of Connecting Metering Transformer Lines to Primaries
Heavy Primary Leads are Looped Behind Cutout Boxes
Do not solder any joints to these primary wires
"See detail in upper right hand corner"
Leads from metering transf.

FIG. 1—POWER AND METER INSTALLATION STANDARDIZED FOR LOADS OVER 25 KVA.

(5) Metering transformer leads must not be shortened by cutting. No splices should be made in the secondary leads between the transformers and the building. Lightning-arrester leads must not be cut, but should be spliced out to the primary. All joints are to be soldered, taped and painted.

(6) A solid board fence 7 ft. high should be built around the pole structure. It should be made in four sections and each section bolted to posts to permit the removal of any or all sides with ease. The gate should be opposite the pole that has the cut-out boxes, so that boxes may be reached at all times without danger. The gate must be kept closed and locked. The poles are to be butt-treated and set 3 ft. deep.

BURTON R. PAYNE,
Manager.
Burdick Electric Company, Inc.,
Lancaster, N. Y.

Remote Control Station for Auxiliary Service

AN OUTDOOR substation has been constructed by the El Paso (Tex.) Electric Railway Company to supply a 2,300-volt power circuit at a point distant from the generating station and is planned for remote control from this generating station. At the present time the substation feeds a section of a two-phase power circuit which has been cut loose from the generating station, but it is the intention to feed this circuit from

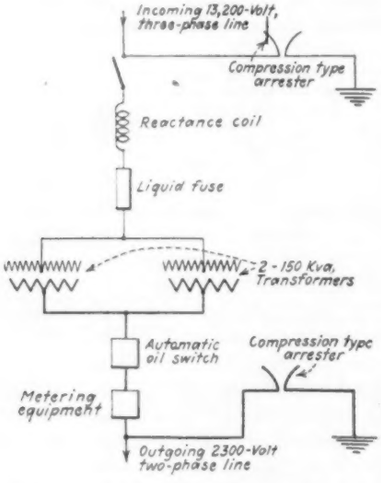


FIG. 1 — FLEXIBILITY OF OPERATION IS ACHIEVED BY AUTOMATIC SWITCHES

both the 13,200-volt, three-phase transmission line and the generating station two-phase bus. The station is equipped with automatic control apparatus protected against serious trouble, and control lines are strung to the generating station so that the substation switches may be operated from the main station, thus doing away with an attendant.

The transformers fit on a concrete floor which fills the area within the 10-ft. high fence that is shown in Fig. 2. Meters are housed within a small wooden building in one corner. The transformers are protected by means of liquid-filled fuses, and flexibility in operation is achieved by the disconnecting switches illustrated in Fig. 1. The poles used are 40 ft. high, and both the poles and the fence are protected against weathering by painting.

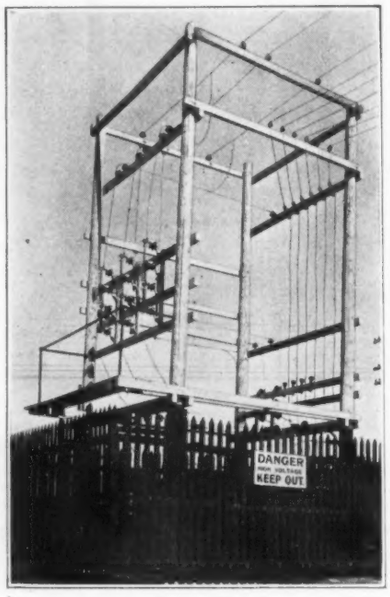


FIG. 2 — THE WIRING OF THIS STATION IS KEPT AS SIMPLE AS POSSIBLE

P. M. HATCH,
Supt. of Light and Power.
El Paso Electric Railway Company,
El Paso, Tex.

High Turbine Vacuum by Attention to Packing

NEGLECT of the carbon packing around the shafts of turbines is one of the prime causes of low vacuum, with a consequent loss of economy. This carbon packing is installed to prevent steam and air leaks, either of which seriously affects the operating efficiency of the machine.

The first requisite of a good carbon packing is that it be fitted properly on the shaft; the second is that the carbon-packing springs be properly adjusted. When these two conditions are complied with the full benefit of the carbon packing will be obtained if close attention be given to the seal valves. When starting a steam turbine the valves on the steam lines to both the top and the bottom carbon packings should be opened sufficiently to overcome the atmospheric pressure. As soon as the machine is on the line and the first-stage pressure is above atmospheric pressure, the steam line to the top seal should be closed. The drain-line valves to the top carbon packing should be handled in such a way as to give the proper drainage. Usually about one and one-half turns of the valve is sufficient. After the machine is running it is necessary to open the steam line to the top seal if an extremely light load is carried or if the machine is motoring in order to obtain enough steam.

PACKING WORN DOWN BY EXCESS STEAM IN SEAL

The lower carbon-packing seal valve should be open at all times when the unit is running and great care must be taken to have the proper amount of steam admitted for various turbine loads, if the highest vacuum is to be maintained. About 1½ lb. steam pressure on the lower seal is usually sufficient when the carbon packing is in good condition. If the valve is opened wide, too much steam will be admitted and wasted, the carbon packing worn down, the packing springs deteriorated and their elasticity lost, the turbine shaft excessively heated, and the step-bearing oil temperature raised.

A low vacuum is often an indication that sufficient steam is not going to the seals, and on opening the seal valves a little it has been found that the vacuum has increased sometimes an inch or more. With a load of 12,000 kw. on a turbine this increase of an inch in the vacuum would mean a saving of approximately 7 per cent in the total amount of fuel used.

When the vacuum is low the first step should be to see that the seals have sufficient steam; then look for air leaks in the turbine casing and the piping to the air pump; examine the air pump to see if it is in good condition; see if the condenser is clean, if the circulating pump is up to speed, if sufficient water is being put through the condenser, or if the carbon-packing springs are rusted out, allowing the packing to fall away from the shaft and making it impossible to get a good tight seal. Any one of these conditions will cause low vacuum with resultant loss in efficiency.

W. E. THOMSON,
Steam-Plant Engineer.
Southern California Edison Company,
Los Angeles, Cal.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Income from Range and Heater Loads*

Analysis of Demand, Power Cost and Diversity Factor of Combined Electric Range and Water Heater Loads in Residential Districts

"PROFITABLENESS of range load" is a different subject from "profitableness of range and water-heater load." For the range load there is a pretty clear case. The water heater alone looks hopeless. The range and water heater combination presents a problem, but also supplies some of the means for its solution, and it is far from hopeless.

The cost of power delivered to the distribution system at the substation will average around $57 per kilowatt-year. From this point on the investment per customer and the operating cost will vary more or less with the class of service.

TRANSFORMER CAPACITIES REQUIRED

It is necessary to install 3 kw. in transformer capacity for single ranges, 5 kw. for two ranges, 7.5 kw. for four ranges and 1.5 kw. per range where more than four are connected to one transformer. In one instance a 25-kw. transformer having a connected load of fourteen ranges and ten 1-kw. water heaters showed a maximum load of 30 kw. for a period of twenty-five months and loads slightly in excess of normal for short periods each day, never exceeding twenty-five minutes.

In adding range load to the ordinary distribution system there is required an average additional investment in the distribution system of about $75 per range, making an annual investment cost of $9 per range. Distribution operating costs will average $6 per kilowatt and the commercial and general expense or customer costs will average $7.50 per customer.

Various group tests show that the average range contributes approximately 1.22 kw. to the total simultaneous demand on the distribution system. This average demand of 1.22 kw. is the result of diversity among cooking customers, but there is also a diversity between this demand and the demand of other classes of customers which we have not yet taken into account and which will further reduce the total simultaneous demand on the station.

Investigations indicate that the average range demand on the station is thus reduced from 0.6 kw. to 0.9 kw.

For the purpose of this discussion we will be conservative and assume 0.9 kw. On this basis the annual cost of service per range is:

Cost of power delivered at the substation	$51.30
Distribution investment cost	8.10
Distribution operating and maintenance	5.40
Customer costs	7.50
Total	$72.30

The average annual kilowatt-hour consumption per range is about 1,700 kw.-hr. and the cost per kw.-hr. is then 4.3 cents.

The successful development of electric cooking is dependent upon some satisfactory solution of the water-heating problem. This problem, however, is fraught with no little difficulty, for water heating in proportion to the power required is a low-value service, and moreover, the load factor is such as to leave no room for dividing the cost with any other class of service. Naturally the greatest convenience to the customer is supplied by unlimited service, but it costs more to furnish such service than it is worth to the residence customer.

MUST LIMIT WATER HEATER LOAD

Several methods have been suggested for limiting the water-heater load. None of them has been very thoroughly tried out in practice, but the most effective and seemingly most workable method yet proposed is the installation of a double-throw switch separating the range and water heater and alternating their use.

It is assumed now that a universal residence service rate is in effect, and that we are delivering power for any and all purposes in the residence through one service and measuring through one meter, thereby reducing the investment and maintenance cost of services and meters. It is also assumed that the range and water heater are required to be connected for alternate use only. What average revenue must we receive from residences using lighting, cooking and water heating in order to pay the cost of service? The total simultaneous demand based on the average customer is:

	Kw.
Lighting	0.25
Cooking	0.9
Water heating	0.5
Total	1.65

The annual cost of service is then:

Cost of power delivered at substation	$94.05
Distribution investment cost — 12 per cent of $125 × 1.65	24.75
Distribution, operating and maintenance	9.90
Customer costs	7.50
Total annual cost	$136.20

Or a total of $11.35 per month. The average kilowatt-hour consumption is:

	Annual	Monthly
Lighting	250	21
Cooking	1,700	141
Water heating (twenty hours per day)	7,200	600
Total	9,150	762

This is an average cost of 1½ cents per kilowatt-hour. Or if the water heater be connected ahead of the meter and charged at $4 per month, the lighting and cooking must pay the remaining $88.20 per year, or an average of 4.5 cents per kilowatt-hour.

The natural division of this cost based on average use is:

	Per Month	Per Kw.-Hr., Cents
Lighting and appliances	$2.25	9.00
Cooking	5.10	3.00
Water heating	4.00	0.55
Total and average	$11.35	1.5

With our present average load factors this is what it costs, but the cost per kilowatt-hour goes down nearly in proportion to the increase

*From a paper presented at the Northwest Electric Light Association convention, Boise, Idaho, June 7 to 10, 1922.

in the load factor, and utility companies can therefore offer very attractive inducements for increased load factor of residence business. The addition of cooking load to any ordinary central-station system will increase the total load factor, and the value of the service will guarantee an average of 3 cents per kilowatt-hour. It is, therefore, profitable business to take on, even when accompanied by that evil but necessary companion, the water heater.

Two golden opportunities are open, however, for increased profits: Cut down costs by adopting the one-meter universal residence service plan. Deliver more service at the same expense by increasing the customer's load factor.

Puget Sound Company Provides Summer Camp

VACATIONS without cost can now be had by the 800 employees of the Seattle division of the Puget Sound Power & Light Company, following the opening of a summer vacation camp on the shore of Lake Kirkley, Wash.

Formal transfer of this camp from the company to the employees was made on July 16 by President Alton W. Leonard and D. C. Barnes, manager of the Seattle division, to a committee of employees. This committee hereafter will have entire charge of the camp.

The idea of a summer vacation camp for all employees and their families was conceived by Norwood Brockett of the legal department of the corporation, and owing to his efforts the plan was brought to a successful culmination. The camp has been named Norwood Lodge in honor of Captain Brockett.

The main buildings consist of a combined dining hall and dormitory on two floors, with every convenience afforded, including running water, electric lights and other electric equipment, part of which is an electric laundry.

A common lodge, 30 ft. by 60 ft., has a large open fireplace, a wide porch overlooking the lake and an excellent dancing floor. In addition to the two main buildings, there is an open-air kitchen with a large

ENTRANCE TO CAMP

hotel range and an open brick oven around which ten or fifteen can cook at the same time without inconvenience. The laundry and the washroom are directly back of the kitchen. Grouped about these buildings are a number of sleeping tents, each in a clump of trees to shade them from the heat of the sun.

The company provided the land and buildings with their equipment and carried on the building construction, but the employees did all of the work of preparing the ground, laying the water mains and installing the lighting and other electrical conveniences.

The establishment of this vacation camp was made possible by the thorough and enthusiastic co-operation of company officials and executive and department heads on the one hand and the employees and their committeemen on the other. It is felt that the first stage of success has been reached with the transfer of actual control to the employees, and that, with the use of a maintenance fund to be provided annually by the company, all of the plans for the development of the finest vacation camp and playground to be found anywhere may be carried out and finally realized.

VIEW OF EMPLOYEES' CAMP, SHOWING LODGE, DINING HALL AND SLEEPING TENTS

Machine Billing Improves Accounting System

ADOPTION of accounting machines and the rendering of customers' electric and gas bills on one statement by the British Columbia Electric Railway of Vancouver, B. C., have resulted in a decided reduction of errors in billing and a consequent decrease in complaints. After eighteen months' operation under machine billing E. H. Adams, comptroller of the company, believes that the new system has had a sufficient trial to permit definite results to be cited.

When the new system was put in effect three distinct changes were made in the company's billing methods, all of which were important and required special preparatory work and careful supervision to bring about successful operation.

1. It was decided, for the convenience of the customer, to render accounts for electricity and gas in one statement, showing the amount due in one total for both services. This was a difficult operation as the services are rendered by two different companies, whose accounting records must be kept separate.

2. At the same time bookkeeping machines were introduced to take the place of hand billing.

3. The use of customers' ledgers was discontinued.

Errors Cut Down

One of the principal reasons for the adoption of accounting machines, which are largely automatic in the hands of well-trained and skillful operators, was the elimination of accounting errors, which, under the hand method, were only too plentiful. Errors in customers' accounts have three direct results: They may affect the company's revenue if the error is in favor of a customer who will take advantage of it. If against the customer, it results in a complaint, which means counter-work and the maintenance of a large staff of clerks to attend to this end of the business.

In either event the correction of errors usually doubles or trebles the amount of clerical work, all of which is costly.

Before the change-over from hand methods it was not customary to check the bills back to the source, namely, the meter-book, and many bills were sent out which, owing to oversight or carelessness on the part of the staff, were incorrectly prepared, resulting in complaints. This did not tend to increase the customers' regard for the company.

Complaints received by the British Columbia Electric Railway are now only a small percentage of what they were two years ago, and the reduction is directly due to the care taken in preparing the accounts (which is partly automatic since the introduction of billing machines), and to the fact that every bill is checked and initialed before being sent out, so that in the event of an incorrect bill getting into the hands of a customer the error can be taken up with the checker concerned.

There is one other source of error which leads to complaints, and the company has taken steps to eliminate this as far as possible. It is natural that there should be cases of over-reading of the customer's meter, which may get to the checker before being discovered. It has been arranged to have checkers hold back for investigation all accounts which show an unreasonable increase in consumption over the previous month, and in this way many complaints are avoided.

In designing this system of consumers' accounting, while speed, accuracy and economy were important essentials, the greater convenience of customers and better service were the principal objectives and results indicate that these have been attained.

Selling Fuses to Customers Lessens Trouble Calls

TO MEET the problem of replacing blown fuses without necessitating a trip by a troubleman whenever a customer's lights go out, the Kansas Gas & Electric Company of Wichita has adopted a plan of selling fuses. A carton containing three fuses is sold for 20 cents. The carton, as shown in the accompanying cut, was designed in a conspicuous black and yellow checkerboard pattern to facilitate locating the box.

All of the company's troublemen carry a supply of these fuses and are allowed a commission of 5 cents on every box that they sell. When they make a trouble call to replace a fuse they almost invariably sell the idea of a standard package and thus lessen the likelihood of another call in the near future for the same kind of trouble. Such calls have so far been made gratis and the fuses were furnished free of charge, but the company feels that the use of these fuses has been made so convenient that it will shortly be able to discontinue the free service.

THIS CARTON OF THREE FUSES IS SOLD FOR 20 CENTS

The replacement of fuses by customers themselves not only materially reduces the expense of "trouble shooting," but is a great convenience to the customer in enabling him to restore his service without having to wait for the arrival of the troubleman. Furthermore, because of the shorter period of interruption there is a greater consumption of energy by the consumer.

What Other Companies Are Doing

Chicago, Ill. — Customer-ownership sales of preferred stocks by companies under the management of the Standard Gas & Electric Company during the month of July resulted in 1,162 transactions, having a total par value of $780,600.

Vancouver, B. C.—This city's first "home electric" will be opened to the public for a period of three weeks beginning Sept. 1. Plans for the electrical equipment call for 197 outlets, including switches, lighting, baseboard and convenience outlets. Intercommunicating telephones and an annunciator system are being installed and there will be two outlets for radio sets. Another feature will be a master switch at the bedside in the owner's bedroom controlling four outside and nine inside lights as a burglar alarm. The operation and advertising of the home will be under the supervision of the Electrical Service League of British Columbia.

Spring Valley, Minn.—Appliances sold by the North West Utilities Company during the last week in July were four washing machines, five flatirons, three toasters, six ranges, thirty-four portable lamps and one oven. Merchandise sales and job orders of this company for July showed an increase of 100 per cent over July of last year.

A Newspaper Page Tells the Utility's Story

BRIGHT AND SNAPPY

The Current

DEALING WITH ENERGY

Published at intervals by the Westchester Lighting Company.

VOL. 5 FRIDAY, JUNE 30, 1922. MOUNT VERNON, N. Y.

Bostonians Told of "The Friend In Need"

"Save What Coal You Have Now for Winter—Make Your Furnace Heat the Kitchen While It Is Heating the Others Rooms in the House"—That Is What Was This Week Urged in Boston.

"Coal prices are high now," the statement began. "With the continuation of the coal strike, prices will probably go higher. When winter comes, it may be impossible to get coal at all. Then will those living in the city where gas and electricity is available realize their advantages over those who cannot obtain it."

"Remember this—no matter what price coal is, or will be, gas for cooking (and electricity is, too,) is a cheap method, because you can control it—keep it down to doing just the work you have to do without waste."

"And," the notice continued, "you pay for just what you use after you have used it."

NO MONEY TO BE SPENT USELESSLY, MR. FISKE AVERS

Of much interest to the city generally was Mayor Fiske's second message to the people of Mount Vernon yesterday.

"Service, efficiency and economy" will continue to be the aim of the administration, he said.

Exceedingly commendable however, was the assertion: "The administration has adopted a policy and will strictly adhere to it, of getting a dollar of value, for every dollar spent and of spending no dollar that is not required to be spent to procure efficient service."

That is no more than the people expect, but some times we

Great Effort Being Made To Avert Walkout of R. R. Men

Chicago, June 30.—All hope of averting the strike of 400,000 railway shopmen throughout the country, called for 10 o'clock saturday morning, depends upon the outcome of the eleventh-hour effort the United States Railroad Labor Board has made to break the deadlock between the carriers and their shopworkers by summoning both sides to appear before the board today

Chicago, June 30.—Chairman Ben Hooper of the United States Railroad Labor Board said last night that he did not believe there would be a railroad strike Saturday. Mr Hooper, it was learned, has held extended conferences with both union and railroad executives in the last two days.

DON'T FLOURISH UNDER DEPRESSION.

Initiative, vision and invention do not flourish under repression and arbitrary regulation, a prominent authority says. About the only real difference between a regulated public utility and a merchant is that the profit of the former is limited; in fact, it has been limited to such a degree that loss has often resulted. "More liberality," the writer continued, "in this is necessary if the consumer is to receive the attention he deserves."

Electrical Power Makes Canada a "Gold Mine!"

Coal "Pinch" Not Felt Half So Much as "Prick" Of Certain Consciences

Publications throughout the country are daily telling of the seriousness of the coal situation

...dence in Electricity

The above illustration shows the effective way in which the Westchester Lightng Company of Mount Vernon, N. Y., is familiarizing the public with the utility business. From time to time the company uses a half page of space made up to have the appearance of a daily newspaper page under the name of "The Current," and in this space matters of public interest regarding the utilities are discussed. The company has found this to be a very satisfactory means of getting its story across to the public without material increase in the cost of its newspaper advertising.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Electricity Supply in Birmingham, England.—Work is just being completed on the new Nechells generating station, which has a present capacity of 30,000 kw. and an ultimate capacity of 105,000 kw. An interesting feature of this plant is the condensing-water system. This water is taken from filter beds from which approximately 3,000,000 gal. per day of filtered sewage water can be obtained for the cooling towers. A description is given of the control room, coal and ash handling systems, cooling towers and circulating-water systems, boiler and engine rooms, step-up transformers and switching arrangements. — *Electrician*, June 23, 1922.

Developments in Power-Station Design.—Generator cooling by washing air from outside and by the entirely closed circuit method are taken up in this article. A short description is also given of the switch gear in large central stations.—*Engineer*, June 2, 1922.

Burning Bituminous Coal on Stokers.—The importance of keeping a bituminous-coal fire agitated and the dangers of using a low-fusing ash are pointed out. Typical stoker installations are described with the best methods for operating them.—*Mechanical Engineering*, June, 1922.

Power-Plant Engineering.— W. G. DIMAN.—A survey of apparatus and requirements for central-station practice is made. The burning of various coals and the question of combustion is taken up, and an idea of what may be expected in various installations is outlined.—*National Engineer*, June, 1922.

Generation, Control and Switching

New Developments in Electrical Apparatus.—D. VOGELSANG.—The author describes a new line of time-controlled and current-controlled switch relays, a 400,000-volt testing transformer set and a 110,000-volt oil switch. The latter two are of special interest. Based upon the Dessauer principle, one single-phase transformer of 200,000 volts and two single-phase transformers of 100,000 volts each are arranged in series, with their low-voltage windings excited from two insulating transformers, resulting in a total potential of 400 kv. against ground. Such a series connection of testing transformers somewhat simplifies the necessary insulation of the individual transformer windings against core and ground and guarantees at least a partial testing voltage in case of a breakdown of one of the transformers. The 110,000-volt, three-phase oil switch is designed for the unusually high flashover voltage of 300,000, a normal operating current of 150 amp. and a rupturing capacity of 150,000 kva. A bushing transformer is built into each one of the high-voltage leads to operate ammeters and the automatic release. Six breaks are provided for each phase, and the contacts are so dimensioned that two of them are longer than the four others. The two longer contacts are connected with a resistor, so that in closing the switch resistance is inserted. This prevents a dangerous rush of current at the instant of closing.—*Elektrotechnik und Maschinenbau*, May 28, 1922.

Turbines at the Hell Gate Station.—The turbine room of this new plant of the United Electric Light & Power Company, New York, contains four main units and two house turbines. These are divided into two groups, each consisting of one 40,000-kw. tandem-compound turbo-generator, one 35,000-kw., 25-cycle single-cylinder turbine generator and one 2,000-kw., 60-cycle house turbine. The 25-cycle main units generate at 11,400 volts and the 60-cycle units at 13,200 volts, the house turbines feeding the auxiliary bus at 2,300 volts. The article describes the main units only.—*Power*, Aug. 8, 1922.

Transmission, Substations and Distribution

Economic Factors Which Determine Power Expenditures.—L. J. MOORE.—The engineer must determine whether the investment planned will pay interest on the money expended through a saving in expense or additional revenue before he recommends new power construction work. A few examples based on actual practice are given to show the working out of economic principles.—*Journal of Electricity and Western Industry*, Aug. 1, 1922.

Transmission at 220,000 Volts.—R. J C. WOOD.—A very complete account of the investigation and research carried on by the Southern California Edison Company to determine whether to increase its transmission voltage to 220,000 or to duplicate its lines in order to meet the increasing demand for electric power. One of the most important features of the research was the equipping of 27 miles of line with additional insulators and shield rings to carry out field tests. This line was energized to 280,000 volts for one month and to 241,000 volts for about five months. Considerable care was taken to obtain reliable measurements of voltage, current and corona losses. The results lead to a firm believe that nothing extraordinary will happen with 220,000-volt transmission. No pressing need of new insulator designs seems to exist. The investigation covered insulation tests, field tests, corona losses, charging currents, residual current to ground, air-break switches, tower design and protective devices.—*Journal of the A. I. E. E.*, July, 1922.

Calculating Size of Synchronous Motor for Power-Factor Correction.—CHARLES A. ARMSTRONG.—The author works out problems by graphically drawing the relation of the energy component of a power load with the reactive component and shows how to draw conclusions from these diagrams of alternating-current loads. — *Power*, Aug. 8, 1922.

Units, Measurements and Instruments

Electromechanical Device for Rapid-Schedule Harmonic Analysis of Complex Waves.—F. S. DELLENBAUGH, JR.—An electric network system for the analysis of alternating-current waves is described in which long mathematical work is eliminated, though the results are practically the same. This method is compared with other methods of analysis, the advantages and disadvantages of each being pointed out.—*Publication No. 28 of Massachusetts Institute of Technology.*

Study of Electrical Insulating Papers —Investigations carried on by the British Electrical and Allied Industries Research Association on untreated insulating papers for purposes other than the manufacture of cables. A schedule of definitions has been prepared and a series of tests developed that have proved suitable for ascertaining the properties of chief importance which these materials should possess. These tests have not been devised as purchasing or acceptance tests, but are for furnishing a basis for the development of such tests. The processes of treatment of the papers during manufacture, such as bleaching, coloring, staining, glazing, etc., are stated. The tests recommended are determination of thickness and density, tensile strength and extension, aging, tearing strength, porosity, chemical tests for determining moisture loss on drying at 100 deg. C., acidity and alkalinity tests, chemical tests for detecting metallic particles, flash tests and crinkling under tension.—*Journal of Institution of (British) Electrical Engineers*, June, 1922.

Illumination

Voltage Regulation with Iron Resistors.—L. BLOCH.—Owing to the great voltage variations which occur on the lines of street railways, any lamps connected to these lines will give a very fluctuating illumination. An improvement can be obtained in such cases by the use of iron resistors. A small iron wire held within a glass bulb in a hydrogen atmosphere will hold the current automatically within

10 per cent, while the voltage may vary within a range of as much as 300 per cent. The reason for this is the very pronounced temperature-resistance coefficient of iron. For example, a 0.5-amp. resistor will maintain 0.47 amp. to 0.52 amp. while the voltage rises from 30 volts to 90 volts. The author gives diagrams from which the proper type of resistor may be chosen for any particular condition. — *Elektrische Kraftbetriebe und Bahnen*, July 24, 1922.

Motors and Control

Application of Electricity in the Manufacturing Industry.—The present article—the second of a series on the subject—deals with the application of electricity to woodworking. A large number of small plants distributed all over Canada, in every city and almost every town, make up the woodworking industry of that country. The demand for power by any one plant is comparatively small, but in the total it is quite large. Individual drive is a feature in this art and makes possible many advantages. Among these are an increased output per machine due to better control, constant speed and many other features, the smaller powerhouse or transformer capacity required, the reduced operating cost, increased safety for operators gained by removing shafting and belts, and that the machine can be placed to the best advantage as regards flow of materials, etc. Several typical installations are illustrated.—*Electrical News*, June 15, 1922.

Details of Coil-Making Methods.—A. C. ROE.—In the article on making up diagrams for coil winders published in the June issue general information and data that should be available when making different kinds of coils were given. In this article additional information is presented on winding particular types of coils. This information is arranged under the names of the various coils that are used in motor windings, including mush coils, bip or flat-mush puller, concentric mush, threaded-in puller, insulated puller, mold-wound and strap-copper coils. Details of laying out, winding and insulating various kinds of coils are outlined and illustrated.—*Industrial Engineer*, July, 1922.

Heat Applications and Material Handling

Manufacture and Use of Commercially Pure Iron in Gas and Electric Welding.—C. A. MCCUNE.—The success of welding depends upon five factors which are of practically equal importance. These are the welder, including methods of welding; the design of weld, the welding equipment, the metal to be welded, and the welding wire. Dependable welding materials should be as free as possible from injurious elements. The welding wire plays an important part in the production of uniformly successful welds. A wire should be of the same general physical characteristics as the base metal, should not contain or tend to create gases, should be free from slag or slag-forming ingredients, should be uniform and should embody ease of operation.—*Journal of American Welding Society*, June, 1922.

Intra-Plant Transportation of Materials.—J. E. HOUSELY.—The details of the system used by the Aluminum Ore Company, East St. Louis, Ill., which provides for the dispatching of trucks, periodic inspection of trucks and cost analysis, are described. In this plant the trucks are at all times at the control of truck foremen, who direct their travel so that runs without load are kept to a minimum.—*Industrial Engineer*, July, 1922.

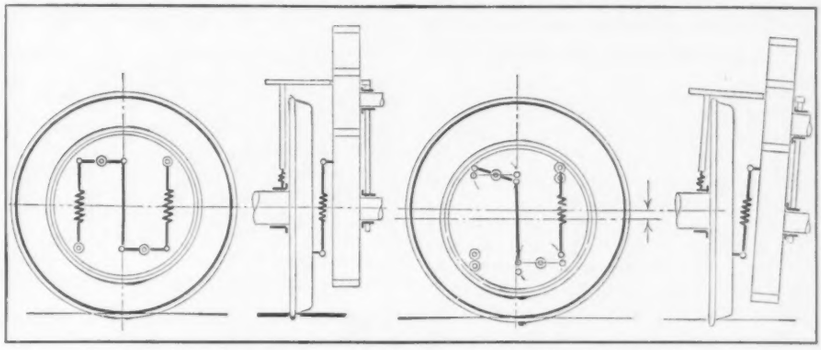
Electrophysics, Electrochemistry and Batteries

Delayed Crystallization in the Carbon Steels.—A. F. HALLIMOND.—The formation of pearlite, troostite and martensite in carbon steels was investigated. The article includes recent researches on delayed crystallization and inoculation, linear crystallization velocity and crystal habits, diffusion of heat and on the material and crystallization in ordinary carbon steels.—*Engineering*, June 16, 1922.

X-Ray Equipment of the Medical College in Würzburg.—K. LASSER and F. JANUS.—According to the totally different requirements of the three departments, three individual sets of apparatus have been installed for diagnosis, operation and therapy. The first of these sets is equipped with a high-tension transformer and a synchronous mechanical rectifier, delivering to the tube up to 120,000 volts direct current at 150 milliamperes momentarily. The second set has an induction-coil-operated tube, installed movably under a special aluminum-top operating table, to be used during operations. The third and largest apparatus consists of two forced-air-cooled high-tension transformers in series and a synchronously rotating mechanical rectifier, delivering from 3 to 5 milliamperes at 200,000 volts for very long exposures to the rays, as required by depth therapy. Modified Siemens-Coolidge Röntgen tubes are used for this purpose in specially designed protective tube holders. The complete equipment has been in use since 1920 and has given very satisfactory performance.—*Siemens Zeitschrift*, May and June, 1922.

Traction

Flexible Drive for Traction Motors.—On the three-phase railway system from Burgdorf to Thun in Switzerland a novel gear drive has been installed which is interesting on account of its great flexibility. The motor with its pinion, an intermediate gear wheel and the driving gear are mounted on the locomotive frame in rigid relation. But between the driving gear and the driven engine shaft is interposed a symmetrical system of double-acting levers and heavy springs, so arranged that a considerable displacement between the centers of the shaft and the gear may take place while a heavy side tilting of the engine frame against the vertical plane of the wheel may occur simultaneously. Such displacements occur in actual service. — *Bulletin Oerlikon*, March, 1922.



COUPLING GEAR OF TRACTION MOTORS THAT IS VERY FLEXIBLE

Telegraphy, Telephony, Radio and Signals

The Design of Loud-Speaking Receivers.—M. ADAM.—This article contains a very detailed description of a serviceable electrodynamic "loud speaker," suitable for home building by the amateur, with drawings and full data.—*Radioélectricité*, June, 1922.

Modulation in Radio Telephony.—L. C. F. HORLE.—The author reviews the various methods of oscillation that have been used in the past and points out lines of experimentation which should be followed up.—*Q. S. T.*, July, 1922.

High-Output Electrone Tubes.—A 5-kw. oscillator tube built of quartz has recently been developed. The cylindrical bulb measures 4 in. in diameter, the electrodes being arranged concentrically. A special process, the nature of which is not disclosed, has been used to insure perfect tightness of the leading-in wires. The filament current is 15 amp. at 16 volts, the plate tension 15,000 volts to 20,000 volts, and the plate can dissipate 2,500 watts, representing an antenna output of 5,000 watts. The bulb is inclosed in a perforated tube, through which a 50-watt fan forces a stream of cooling air. A life of 2,000 hours may be expected of the tube.—*Radioélectricité*, June, 1922.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

To Honor Edison on Anniversary of Electric Light

Monday next, Sept. 4, is the fortieth anniversary of the inauguration of electric lighting service, which took place in 1882 in New York City in a converted brick warehouse at 255 and 257 Pearl Street. Electrical men in that city are planning to observe the anniversary with a dinner at which Thomas A. Edison and his surviving associates of forty years ago are to be the guests of honor. The dinner will be held at the Commodore Hotel on Monday evening, Sept. 11, and will bring together the leaders of the electrical industry from all over the country.

A historical collection of early electrical apparatus is also being assembled. This collection is being gathered by the Edison Pioneers—the men who worked with Edison forty years ago—and by the Association of Edison Electric Illuminating Companies. It will be on public view at the Grand Central Palace during the Electrical and Industrial Exposition, which begins on Oct. 7. Included in the collection will be one of the "jumbo" generators from the original Pearl Street station. This is the only generator that was saved when fire partly destroyed the station in 1890.

The *Electrical World* for next week —Sept. 9—will be an anniversary issue and will cover the history of the development and progress of the electric light, heat and power industry, beginning with the Pearl Street installation.

Muscle Shoals Fight Goes On

Representative Garrett of Tennessee, acting minority leader of the House of Representatives, is still endeavoring to force consideration by that body of Henry Ford's offer for Muscle Shoals. By parliamentary tactics he prevented a proposed three-day adjournment of the House, and he hopes to bring about such a clearing of the calendar that nothing will obstruct the introduction of a resolution on the matter.

No eagerness to take up the Ford offer is shown by the majority party, and it is likely to go over to December.

President Authorizes Use of $600,000 for Wilson Dam

Funds totaling $600,000 have by authorization of President Harding become available to enable army engineers to begin construction work on the Wilson Dam at Muscle Shoals, Ala., on an extensive scale, pending use of the appropriation of $7,500,000 by Congress, which will become available on Oct. 1.

Brigadier-General Taylor, Assistant Chief of Engineers, explained that the $600,000 was part of an old appropriation of which an unexpended balance of about $900,000 remained subject to Presidential disposal. The remaining $300,000 is reserved and probably will be allowed the Agriculture Department for use in making experiments with nitrogen for fertilizer.

Power Possibilities of Upper Snake River

Confirmation of the power possibilities of the upper Snake River has been made by L. A. McArthur, general manager of the Pacific Power & Light Company of Portland, Ore., which has filed an application with the Federal Power Commission for a preliminary permit for the development of water-power sites on that river between Huntington, Ore., and Lewiston, Idaho. A report made by engineers in 1920 put the potential energy of this part of the Snake River at 900,000 hp.

Mr. McArthur journeyed on a powerful gasoline launch from Lewiston to Pittsburgh Landing, about 77 miles up the stream. This part of the river is not navigable for steamboats on account of its numerous rapids, full of whirlpools and rocks. An idea of the stream's velocity may be had from the fact that it took a day and a half to make the up trip and only four and three-quarters hours to return.

Low Water at Keokuk Hinders Stations on Mississippi

Factories at Alton, Ill., and several other Mississippi River cities served by electric power companies which depend on the development at Keokuk, Iowa, for their energy have lately been obliged to curtail their operations to some extent because of low water in the river. Even the Union Electric Light & Power Company of St. Louis, which has first call on the Keokuk output for its constant or "firm" power, has had its excess supply cut to some extent and has had to make up the deficiency by steam-generated power.

Under rulings now in force the amount of water allowed to pass through the turbines at the Keokuk Dam is limited to insure a supply for river craft. It is reported that appeals have been sent to Washington in the hope that something can be done to remedy the situation.

Permit for Entire Power on Cheat River Sought

Much significance is attached by the Federal Power Commission to the application of the West Virginia Power & Transmission Company for a preliminary permit covering a comprehensive development of the entire Cheat River in West Virginia and Pennsylvania. This is one of the three streams which were considered by the government as possible sites for the national nitrate plant which afterward was built at Muscle Shoals on the Tennessee River. The applicant for this preliminary permit is understood to be very closely allied with the West Penn Power Company, which has an extensive transmission system throughout the industrial territory tributary to Pittsburgh and Wheeling. That company is operating two large power plants at the mines which supply its fuel. It is the idea to develop all the available power on the Cheat River to interconnect with these plants in the carrying out of a super-power project.

The West Virginia Power & Transmission Company already has a permit from the War Department for a large development near the state line between Pennsylvania and West Virginia. It is now asking the Federal Power Commission for a permit to cover ten additional developments which will utilize all the fall of the Cheat River and virtually all the reservoir sites along that stream. The primary power available is estimated at 300,000 hp., but equipment capable of developing at least 500,000 hp. will be installed.

The idea of this development is the same as that of the scheme recently proposed for the Clarion River. Instead of using steam as an auxiliary to water power, the intention is to reverse this method so that the water power will be used to take the peaks off the steam load. The site is in the very heart of one of the largest coal-producing regions of the country.

Applications to Power Board

The San Gorgonia Power Company, First National Bank Building, San Francisco, has applied to the Federal Power Commission for a license to cover two diversion dams, conduits, pipe lines and power houses on the San Gorgonia River in Riverside and San Bernardino Counties, Calfornia.

The Virginia-Western Power Company, Clifton Forge, Va., has applied for a license covering an existing power project on the James River at Balsony Falls, Va.

Production of Bituminous Coal Increases

Secretary Hoover Believes that Shipments Will Meet Demands—The Interstate Commerce Commission Arranges Priorities, Putting Utilities in Class 2—Strike Situation Improves

THE general strike situation has improved to such a degree as to cause the officials at Washington to reject any plan to seize mines and railroads in the interests of public welfare. Coal production has increased, although the anthracite-coal miners and operators are still deadlocked.

On Aug. 29 Secretary Hoover of the Department of Commerce issued a statement to the effect that during the next six weeks the railroads may be called upon to move seventeen million tons of coal a week. "We believe that we shall be able to take care of the fuel needs of the country," Mr. Hoover said, adding that the test would come within the next two weeks.

The administration's optimism that coal shipments can be kept up with the new demands is apparently based upon confidence that its policy of giving priority to coal movements, even to the extent of the annulment of a large number of mail, passenger and ordinary freight trains, will achieve the desired results.

Interstate Commerce Commission Issues Priority Order

Official action of far-reaching importance to the country's public utilities was taken on Aug. 29, when the Interstate Commerce Commission issued Amendment No. 4 to Service Order No. 23, which restricts Class 1 priorities on coal to such extraordinary cases as may be designated from time to time by the commission. Coal intended for emergency uses generally is included in Class 2 priority. Owing to the limited time during which lake transportation will be available, shipments of coal on the lakes may be made under Class 1 priorities. Public utilities come under Class 2, the regulation governing which is as follows:

"Class 2. For fuel for railroads and other common carriers and for bunkering ships and vessels; for public utilities which directly serve the general public, under a franchise therefor, with street and interurban railways, electric power and light, gas, water and sewer works; ice plants which directly serve the public generally with ice or supply refrigeration for human foodstuffs; hospitals; for the manufacture and production of foodstuffs and medicines, and for the manufacture of containers therefor; for the United States, state, county or municipal governments, and for their hospitals, schools and other public institutions—all to the end that the foregoing may be kept supplied with coal for current use for such purposes, but not for storage, exchange or sale; for bituminous coal consigned to a pool or pools of lake cargo or bunkerage coal at any port upon Lake Erie for trans-shipment by water to ports above Lake Erie; bituminous or anthracite coal or coke for household use and for the heating of buildings. It is not intended by this paragraph to give any priority as between the classes of persons and uses mentioned herein."

The issuance of this amendment brings the situation back to that which existed when John W. Lieb issued his first circular to the public utilities. It is expected to correct the evils arising under federal fuel distribution, which was cutting off a large number of public utilities from their regular fuel supply, leaving them in an emergency class and compelling them to buy coal at prices greatly in excess of their contracts.

Government Price Control Ceases Temporarily

Federal control of coal prices and of distribution of fuel by volunteer organizations stopped on Aug. 28, pending the passage of emergency legislation by Congress. Fuel Distributor Spencer issued the following statement:

"The agreement as to price restraint with the non-union operators expires today with the resumption of the union bituminous mines. About 70 per cent of the operators have held to this agreement, and it is felt that the public has been saved a very large sum.

"Pending the action of Congress and the state authorities, the only restraint upon price is the schedule of fair prices declared by governors or by state coal commissioners in some of the states, to which it is earnestly hoped the operators and dealers will conform. These prices are about $4.50 a ton maximum in the Kentucky, West Virginia, Tennessee and Virginia fields, $3.75 for Pennsylvania thick vein and $4.75 for thin vein. Standards have not yet been set in other states.

"The legislation before Congress can only control the price of coal moving over state lines, that is, in interstate commerce. The price of coal produced and consumed in a state, together with the charges which wholesalers and retailers within the state may make, the latter including even interstate coal, should be controlled by the state authorities. There can be no real control of profiteering unless the state authorities act."

Except in the upper lake sections, Mr. Spencer said no more coal would be directed to different states under emergency priority orders of Class 1 unless a situation arose which warranted such forced measures. A new plan for the fuel relief of the Northwest is in process of formation by the Interstate Commerce Commission and the Fuel Distribution Committee.

Reports reaching Washington indicate that the public utilities are getting their share of the increased volume of coal being produced, but owing to the fact that reserves have been so generally used up, the situation of a large number of utilities will continue to be serious for weeks to come, particularly since they are not allowed to build up stocks and because of the uncertainty of transportation.

Wisconsin Commission Takes Hand in Coal Situation

The Wisconsin Fuel Commission has delegated authority to the Wisconsin Railroad Commission by which the latter body will have direct charge of ascertaining the coal requirements of all public utilities and devising means of procuring coal for them. The commission has obtained the services of John N. Cadby, executive secretary of the Wisconsin Utilities Association, in its effort to speed coal shipments.

J. P. Pulliam, president of the Wisconsin Utilities Association, in an address at the midsummer session of the street-railway division of the Wisconsin Utilities Association, said that electric and gas utilities would probably be forced to adopt a rationing plan in the distribution of their service as soon as the cold weather sets in. He also said that unless the coal-hauling equipment of the railroads was improved many electric and gas utilities would be forced to shut down, owing to the fact that householders would attempt to use gas and electricity to heat their homes when they found they could not procure coal and would thus overtax the supplying plants.

High Price of Coal Troubles Indiana Utilities

Indiana public utilities will be forced to seek higher rates immediately or go into the hands of receivers, if they are compelled to pay present prices for coal, which are 100 per cent higher than before the coal strike, according to John W. McCardle, chairman of the Indiana Public Service Commission. Mr. McCardle is seeking to obtain regulation of coal prices in Indiana by the Interstate Commerce Commission.

"Many of our public utilities are almost out of coal," said Mr. McCardle. "Some are buying wood at enormous prices to keep their service to the public. They are being compelled to pay outrageous coal prices, but are themselves receiving the same rates that were in effect before the strike. Indeed, the rates of many have been decreased."

The return of the Indiana miners to work means little immediate relief to the utilities of the state. Indiana operators say it will be at least four weeks before normal production will be reached. Cave-ins during the five months the mines have been abandoned, necessary repairs to machinery and the like will make it impossible to hoist coal as it should be done in view of the present emergency.

The rail officials of the state have promised cars sufficient to take care of maximum production, but the operators are taking these assurances with sev-

eral grains of salt. They say that never yet have the railroads been able to handle coal in Indiana when the mines were being worked to capacity, and they feel sure that, with a strike of rail employees being fought out, three or four days a week will be the limit of production.

English Coal Causes Trouble in American Stokers

Difficulty in burning the coal recently imported from England has been reported from several plants, notably those of the Interborough Rapid Transit Company of New York City and wherever high rates of forcing are employed. It is thought that modifications will have to be made in the stokers if the load is to be carried in the same way as American coal.

At the plants of the Interborough company approximately a third of the boilers are being supplied with Welsh coal. According to analysis this is a high-grade coal, running about 14,500 B.t.u., 15 per cent volatile and 6 per cent ash. Up to 200 or 225 per cent rating of the boilers the coal gives excellent results, but above this rating it cakes and does not permit the proper amount of air though the fuel bed. At these plants the boilers are forced as high as 320 per cent rating, and it is therefore impossible to get more than 70 to 75 per cent capacity. It was found that the older-type overfeed stokers handled this coal better than underfeed stokers.

It soon became apparent that this condition would be aggravated, possibly to the point of a power shortage, as the reserve supply of American coal became used up and more and more boilers had to be run with English coal. The engineering force has endeavored to meet the difficulty by increasing the air passages through the stokers, cutting down the velocity and the pressure from 5 in. to 3 in. and increasing the volume of air. Tests under these conditions are being made for the Transit Commission by Professor Lucke of Columbia University.

California Commercial Bodies Oppose Power Act

Action against the proposed "water and power act" of California has been taken by the Chambers of Commerce of both Los Angeles and San Francisco in the form of resolutions just adopted by the respective directors of these bodies. This action is based upon a hearing given by these organizations to both sides of the case and would seem to be a fair indication of the position taken by business interests on the proposed law. The action of these bodies, the leading commercial associations of the state, confirms the recent survey made by the *Electrical World* of the opinions of the newspapers in all sections of the state, which showed an overwhelming majority opposed to the measure. The bill will be voted upon at the November election.

Would Bar Out Commission

Lima, Ohio, Asks Ohio Power Company to Sign Away Its Right of Appeal to State Body

AN UNUSUAL utility situation has arisen in Lima, Ohio, where the City Commission, the municipal governing body, demands that there be inserted in a proposed contract for electrical energy with the Ohio Power Company a clause excluding the Public Utilities Commission of Ohio from participation in any controversy that might arise during the life of the franchise granted. This provision as drawn up by the city authorities reads as follows:

"It is expressively agreed by and between the City of Lima and the Ohio Power Company, for itself and for its successors, lessees and assigns, as a part of the consideration of this contract, that neither the Public Utilities Commission nor any other commission or state agency, or any other agency now or hereafter established or created, except the City Commission of Lima, Ohio, and its successors, shall have the right to change, alter or amend or increase the rates, prices or other matters and things herein provided for; and it is expressly agreed that if the said Ohio Power Company, its successors, lessees or assigns shall at any time during the continuance of this contract petition to, apply to or appeal to any such commission or state agency now existing or hereafter created from any order, regulation, rate, price or other thing now or hereafter established by the City Commission of Lima, Ohio, or its successors, that thereby, immediately upon the filing of any such appeal, petition or application to said Public Utilities Commission or to any other state agency or board or commission, this contract shall, without any further action by the City Commission or its successors or any other person, be revoked and held for naught and shall thereupon immediately terminate and become null and void."

COMPANY'S REPRESENTATIVE WALKED OUT

The insistence on this clause led to a rupture of negotiations between the city and the company, the representative of the latter walking out of the meeting at which it was attempted to force its acceptance. The city commissioners contend that future disputes should be settled directly between the two parties concerned. The view of the company doubtless coincides with that expressed to a local paper by D. J. Cable, who represents stockholders of the Lima Street Railway Company. Mr. Cable is quoted as expressing these views:

"In my opinion, the provision is unjust and highly improper, its effect being that after large investments are made by a company in providing a service for the city its rights may be terminated if it defends them according to the established law of the land. Such a clause would render financing impossible by any company. Securities issued based upon such a contract could not be sold.

"Furthermore, a company entering into such a contract to disregard the law of the land, the procedure established by the constitution and statutes of the state, stultifies itself and does an un-American act, even if such a clause would have no legal effect. Any such arrangement is the breeder of more trouble and litigation than almost any provision that could be devised."

Ontario Hydro Commission's Annual Report

The fourteenth annual report of the Hydro-Electric Power Commission of Ontario has been completed but will not come from the printers for some time. This report, which is for the year 1921, shows the results of operation in 205 municipalities by ten separate and distinct systems. As usual the Niagara system stands in a class by itself owing to the relatively low price of power and the large industrial loads, which give the maximum benefits of loaded transmission lines and transformer stations. Out of a total of 131 municipalities embraced in this system, there were but seven showing actual money loss, amounting to a total of $1,675.87, while the total gross surplus in the remainder amounted to $1,474,738.66.

It must be understood in this connection that the Hydro-Electric Power Commission has no profit and loss account. The apparent deficits and surpluses indicated in this operating report are passed on to the municipalities and incorporated in their cost of power, so that the summary of municipal operation is the real measure of the success or failure of the general scheme of co-operative development, transmission and distribution of electrical energy at cost under the power commission act.

The operation of the smaller systems may as a whole be considered quite as satisfactory as that of Niagara. Out of a total of seventy-four municipalities served by nine different systems, there were twenty-five which showed a gross loss, this list being largely made up of the new municipalities connected to the Eugenia and St. Lawrence systems during the year. In these the operation covered but a few months and the revenue was far below normal. While these gross deficits totaled $39,604.77, the rest of the municipalities in these systems accumulated a gross surplus of $235,765.39, so that collectively the year's operation showed a gross surplus of $196,160.62. The summary shows that out of a total of 205 municipalities there were thirty-two which failed to meet all the operating expenses, including the debenture charges and the full cost of power, and there were in all fifty-one which failed to provide full theoretical depreciation. However, the summary also shows a net surplus of $625,602.26 after providing for depreciation to the extent of $1,043,620.85.

Gisbert Kapp Dies at His Home

Distinguished British Electrical Engineer Ranked with the Leaders of the Profession—Sketch and Tribute from a Co-worker and Lifelong Friend

WORD has reached the United States of the death of Gisbert Kapp on Aug. 10, at his home in Birmingham, England. Professor Kapp's eminence as a pioneer in electrical engineering is recognized in America as well as in Europe. The following brief account of his achievements and tribute to his memory is contributed to the *Electrical World* by his lifelong friend, B A. Behrend, consulting engineer, of Boston:

"The name of Gisbert Kapp has been a household word to a generation of electrical engineers, to whom his books and papers were beacon lights at a time when the art was well-nigh a pathless jungle in which we were frontiersmen.

"The career of Mr. Kapp, like his commanding personality, has been a fascinating one. Born near Vienna, Austria, of a Scotch mother, he went to England as a youth, becoming an ardent devotee of English life, ideas and manners. He devoted himself at first to mechanical design, and he developed for the Allens centrifugal pumps and other pumping machinery. In 1882 he joined Colonel Crompton at Chelmsford, where he invented the compound-wound direct-current generator. He told the present writer how he conceived the idea, and how he paid for the experimental coils himself, in view of the speculative nature of experimental work of that character at the time. He left Crompton two years later and set up as consulting engineer in Westminster. He then began his association with Johnson and Phillips, and he designed numerous power stations completely, including all the electrical machinery and apparatus, among them being particularly the St. Pancras station.

His Grasp of Alternating-Current Theory

"When Tesla's patents appeared in 1888 Kapp instantly recognized their value and through his friendship with Dobrowolsky and C. E. L. Brown he became the leader and inspirer of these men. The present writer had the privilege on numerous occasions, while assistant to Mr. Kapp, to be present at these inspiring sessions, which lasted late into the night at Mr. Kapp's house, and the memory of the exchange of ideas among them and their capacity for rapid thought is still a source of delight to him. Mr. Kapp understood the theory of alternating currents. He not only understood this theory, but he knew how to present it to the reader. Our William Stanley paid him a high compliment when he republished in this country, in 1893, a series of lectures by Kapp on alternating currents. His books were eagely sought by students and engineers, and no one ever laid them down without obtaining enlightenment and accurate knowledge. They were the works of a scholar, but their presentation in lucid plain English was of infinite value at a time when mathematical jargon obscured the theory. Mr. Kapp was happy among a group of men with whom he was connected through intimate friendship. William Morris Mordey, John Perry, the Hopkinsons, Professor Ayrton—the names of these great Victorians suffice to bring out the atmosphere in which he lived.

"Following the electrical exposition at Frankfort-on-Main in 1891, and the

GISBERT KAPP

great interest aroused by the demonstration of the transmission of energy by means of Tesla's three-phase system over a distance of 100 km. at 30,000 volts, Mr. Kapp was led to consider, and eventually to accept, an offer from the Association of Electrical Engineers of Germany to take up the work as their general secretary. Although Mr. Kapp's activities during his incumbency of this position were most useful, he was never happy in his surroundings, and when Sir Oliver Lodge, on the advice of the late Sylvanus P. Thompson, offered him the professorship of electrical engineering at the University of Birmingham he eagerly accepted, to return to the country to which he was devoted. Here, at the University of Birmingham, he built up the electrical engineering department, and he published a treatise on the 'Principles of Electrical Engineering' which constitutes his last published work.

"Among Mr. Kapp's greatest achievements is the exposition of the theories of the magnetic circuit in dynamos. He once showed to the present writer sketches in multicolored pencil made by Lord Kelvin—then Sir William Thomson—which the latter had given Mr. Kapp in the course of their discussion of the theory of the magnetic circuit. Next in order of time came his vector analysis of alternating currents, which was summed up in a remarkable lecture before the British Institution of Civil Engineers. In this paper he explained the "Ferra effect," viz., the rise in voltage over Ferranti's 10,000-volt cables from Deptford to London. He explained in a simple manner, following, however, strictly scientific methods, these complex phenomena, and this work is to-day a classic in the analysis of a difficult engineering problem. Next in order he wrote his treatise on 'Dynamos, Alternators and Transformers.' In this he produced for the first time tables for the windings of direct-current machines, and he summed up the entire history of the calculation of 'dynamos and alternators' in a manner which has never been excelled and which is a classic in engineering literature. Then he wrote his treatise on 'Electric Transmission of Energy,' which went rapidly through four editions. In this he treated the theories of polyphase currents, the theory of wattmeter readings and their corrections, the theory of the rotating field, the theory of the calculation of long-distance lines, applying Kelvin's law for the most economical cross-section, and, last but not least, he emphatically stated his position of complete faith and confidence in alternating currents, and polyphase currents in particular. Needless to say, this prediction has been completely vindicated by events.

"These labors were followed by a small treatise on transformers which it is yet a delight to read. A larger work on dynamo design, in which the present writer had a share as assistant, followed. Papers on boosters to compensate for the electrolytic destruction of the return current in electric railway plants and on the pendulum oscillation of alternators have become unique and classic contributions.

Recipient of Many Honors

"Mr. Kapp received many honors. He was a Telford medalist, he was made honorary doctor of engineering, president of the British Institution of Electrical Engineers, and president of the Engineering Section of the British Association for the Advancement of Science. He was extremely fond of yachting and also of golfing. He loved his garden at his beautiful country house, 'Treganor,' in Selly Park, Birmingham. In 1884 he was married to Theresa Mary Krall, a gifted Englishwoman and a brilliant musician and singer. Their marriage for thirty-eight years was one of complete devotion and harmony. Two sons, Norman and Reginald, both engineers, survive their father.

"To the present writer Mr. Kapp and his wife were almost like foster-parents. Let the chronicler thus be allowed to wind up these last words of tribute with the touch of profound affection and esteem which he would fain lay at the bier of his great teacher and friend."

Wisconsin Electrical Code

New Rules Adopted by Railroad and Industrial Commissions to Be Discussed by Utilities

THE new Electrical Code adopted by the Industrial Commission in conjunction with the Railroad Commission, which becomes effective Sept. 13, will be the subject of discussion by superintendents and engineers of public utility plants in Wisconsin. J. N. Cadby, executive secretary of the Wisconsin Utilities Association, is making plans for such a conference.

The new code consists of five major portions as follows: 1. Introductory part, consisting of the general requirements, definitions of special terms and the methods to be pursued when making protective grounds where called for elsewhere in the code. 2. (Part 1) Construction requirements for electrical supply systems, substations and equipments of such stations. 3. (Part 2) Construction requirements for electrical supply and signal lines, both overhead and underground. 4. (Part 3) Construction requirements for electrical utilization equipment, which means ordinary interior wiring and all equipment utilizing the electrical energy, as, for instance, lighting equipment, motors, heating and welding apparatus. 5. (Part 4) Safety measures to be observed in the operation of electrical equipment and lines.

The latter rules apply in particular to employees in stations and substations and on electrical supply and signal lines, since such equipment cannot always be completely guarded and it frequently becomes necessary temporarily to remove such guards as may have been installed. Therefore the safety of employees must be attained to some extent through the observation of proper precautions while at work about such unguarded equipment.

Three important new requirements for utilization equipment and wiring are as follows: (1) The placing of all service entrance wires in conduit; (2) the requirement that all knife switches except on switchboards be of the so-called safety type; (3) the requirement that all new wiring of lighting circuits be of the so-called polarity type, i.e., the grounded wire to be identified by an outer braid differently colored from the other wires.

The committee which drafted the code comprises the best talent in all branches of the electrical industry. C. B. Hayden, engineer of the Railroad Commission, was chairman and John A. Hoeveler, electrical engineer of the Industrial Commission, was secretary. Two years was devoted to a complete study of electrical safety requirements. The new code is based in large part upon the National Electrical Code of the National Board of Fire Underwriters and upon the National Electrical Safety Code of the Bureau of Standards. It therefore comprises a complete standard for electrical construction and is aimed to conserve both life and property.

Vacation Season Affects August Financing

The rush of utilities to obtain funds for making extensions and betterments during the summer is over, as is evidenced by the August stock and bond issues of electric light and power companies, which amounted to only $9,809,000. The large decrease under the total reached in July which this figure denotes resulted from the falling off in both the size and number of single issues and the inopportune season for issuing new securities. There were seven single issues offered in August; in July there were nineteen. The only issue last month which exceeded $3,000,000 was that offered by the Indiana General Service Company, amounting to $3,322,000. During July six issues exceeded the three-million-dollar mark. The rate of return yielded the investor was 6.60 per cent, as compared with 6.61 per cent for the month of July. All the issues were long-term securities. The utility security market is stable and new issues have been taken immediately at favorable rates.

Southwestern Activities

Public speaking and company organizations as methods of building good public relations were recommended by the executive committee of the Southwestern Geographic Division of the National Electric Light Association, which met in Dallas, Tex., recently and selected Oklahoma City as the place for the meeting in March or April next in connection with that of the Oklahoma Utilities Association.

The meeting of the executive committee was attended by about thirty executives and central-station representatives from Oklahoma, Louisiana, Mississippi, Arkansas and Texas. President E. H. Kifer of San Antonio appointed several committee chairmen. The meeting heard a report on the work of the Texas Public Service Information Bureau and made arrangements to co-operate with the bureau in educational and public-speaking work.

Arrangements have been made for a course in utility economics at each of the colleges and universities of Texas where such course has not already been established and for co-operation in colleges that have such courses.

New Plant on Housatonic

Work is reported as about to begin on excavation for the Connecticut Light & Power Company's new plant at Devon, Conn., on the Housatonic River. The plant will be one of the largest central stations in New England, covering 55 acres, and will have an ultimate rating of 150,000 kw. or more. The original plans, if carried through, will entail a cost of approximately $4,500,000, this figure including the plant and the transmission lines, of which there will be about 75 miles.

The station will, either directly or indirectly, furnish power to every city and town in western Connecticut. The towns and cities to be directly served include Waterbury, New Britain and all the towns in the Naugatuck valley, while those furnished indirectly are in western Connecticut.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Indiana General Service Co.	$3,322,000	Twenty-four-year	First mortgage gold bonds	To provide funds for additions and extensions	5	90	5.75
Tennessee Electric Power Co.	3,000,000	.....	Cumulative first preferred stock	To provide funds for additions, maturing obligations and floating debt	7	90	7.75
San Diego Consolidated Gas & Electric Co.	1,500,000	Twenty-five-year	First and refunding mortgage gold bonds, series B	New construction	5	87	6
Matachewan Power Co., Ltd. (Province of Ontario)	450,000	Fifteen-year	First mortgage sinking-fund gold bonds	.....	7	95 (with 20 per cent common stock bonus)	7.50
Wheeling Electric Co.	487,000	Nineteen-year	First mortgage gold bonds of 1911	To provide funds to reimburse company for expenditures for additions and extensions	5	92	5.70
Iowa Light, Heat & Power Co.	400,000	Thirty-year	First mortgage sinking-fund gold bonds of 1916	To reimburse company for expenditures for extensions and improvements, to reduce floating debt and for other corporate purposes	5	84½	6.25
Lower St. Lawrence Power Co. (Province of Quebec)	650,000	Twenty-five-year	First mortgage non-callable gold bonds, series A	.....	7	97	7.30
Total	$9,809,000*						

*The issue of $270,000 of preferred stock of the Associated Gas & Electric Company appearing in the table of July securities was included in error. This was not a new issue, but merely represented the sale of stock of certain interests to others.

Wiring and Tree Trimming

Need of Better Work in Both Directions Is Emphasized at Michigan Convention

STRONG support of the enforcement of the National Electrical Code as a means of preventing the hazards of poor wiring was voiced in the report of the wiring and meters committee of the Michigan Electric Light Association before the annual convention at Ottawa Beach on Aug. 21-23, whose proceedings were outlined in the *Electrical World* for Aug. 26. As a means to the desired end the committee expressed itself as of the opinion that no one should be permitted to do electrical wiring unless he had qualified before an examining board. State legislation looking toward the licensing of contractors and electricians was suggested in the report, and a form of law was presented.

In the discussion of the report Henry Roseberry, president of the Michigan Contractors' Association, expressed himself as strongly in favor of regulation of wiring practices so that work would be uniform all over the state and all the safety measures which have been found necessary in the cities would be enforced in the smaller places.

Tree trimming was discussed by H. P. Sedwick and H. J. Eddy of the Public Service Company of Northern Illinois, who told of experiments last year that led to the employment of a qualified forester to handle tree trimming for that company. An experiment was first tried in part of the territory by the employment of a forestry organization of national reputation. The entire work of obtaining permits, trimming and cleaning up was turned over to this organization, and the results led to the employment of the trained men referred to. Under the supervision of this man trimming gangs composed of a wagon foreman who must be a hot-wire man, three trimmers who need not be hot-wire men, a groundman and a driver who also does ground work do all the tree trimming on the system of the company.

In the discussion Mr. Eddy emphasized the fact that the first trimming under such a plan is expensive because every effort is made to put the trees in proper condition, just as though the trimming were being done with that object in view, and to trim so that future growth will be in the direction of least interference with the power circuits near by. Subsequent trimmings will be aimed at maintaining this condition and will be less onerous and more rapid.

President Smith of the N. E. L. A. in his address said he was not expecting to initiate new and spectacular policies, but that there was ample room for hard work in pushing to completion the various lines of activity that have been inaugurated in previous years. He emphasized the national scope of the central-station problems. Harry Reid of Indianapolis, Ind., president of the Great Lakes Division of the N. E. L. A., Carl D. Jackson, president of the National Association of Railway and Utility Commissioners, and W. L. Goodwin also addressed the convention.

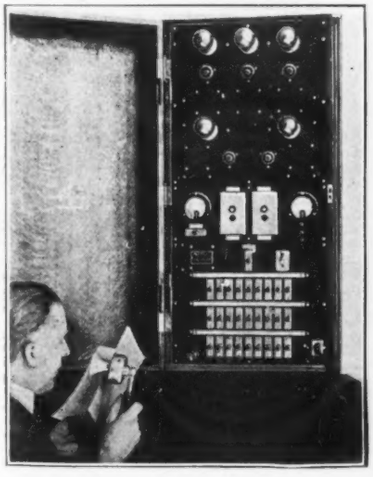
The report of the committee on public utility information showed progress under the leadership of Alfred Fischer.

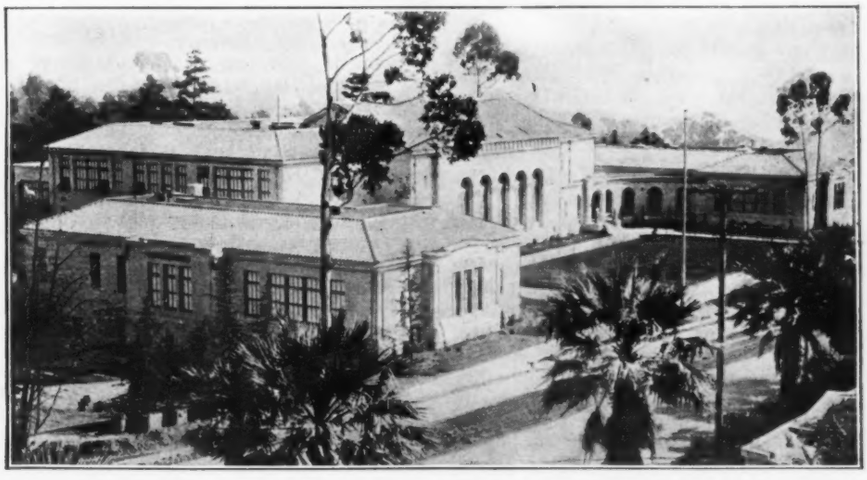
Rural Line Problem Studies in Michigan

For the consideration of rural lines as an economic problem, free from political and other influences, the Michigan Public Utilities Commission has appointed a committee of sixteen to investigate the subject. The chairman of this committee, David Friday, president of Michigan Agricultural College, is assisted by the State Commissioner of Agriculture, the master of the Michigan State Grange, the president of the State Farm Bureau, the entire rural lines committee of the Michigan Electric Light Association, one specialist on rates and standards of service and the director of the Michigan Committee on Public Utility Information. Two engineers of the commission are advising.

Professor Friday sought first to determine the elements of cost and established to the satisfaction of the agricultural representatives that the greatest item of expense comes in establishing and maintaining the distribution system. He has asked his associates to determine whether electric power is worth what it costs the farmers. At the present time a number of sub-committees are at work. Each of these committees has representatives of both agricultural and utility interests. One of these is determining the uses of light and power on various types of farms. Another is working out a plan upon which rates will be based, with the idea in mind of finding a workable formula which will be applicable generally. A committee on public policy is investigating the legal phases of the problem.

"Loud-Speaker" Installation in Piedmont (Cal.) High School





AN INTERESTING installation has recently been completed for the Piedmont High School, Piedmont, Cal., involving a distinct improvement over present methods of inter-classroom communication. The apparatus, which was developed by the Magnavox Company, a pioneer in the field of devices for sound amplication, consists of a central or master station and twenty-five receiving stations, each equipped with a "telemegraphone," the motor-generator and battery being installed in a steel cabinet in the basement. The master station is operated like an ordinary telephone. Talking into the instrument in usual tones, the speech is amplified in any or all of the twenty-five classrooms in sufficient volume to be distinctly audible to all the students. Radio entertainments can also be heard over the system if desired. Similar installations have been developed for hotel, railroad terminal and other commercial uses, but this is the first application of the "loud speaker" to school service.

The illustrations show the Piedmont High School and the principal talking to his scattered audience.

Brief News Notes

A New Plant for Dallas.—Formal approval of the plan of the Dallas, (Tex.) Power & Light Company for the construction of an electric power station to cost $2,180,000 has been given by the city, and work will start at once. It will take about eighteen months to complete the plant.

Birmingham Substation Struck by Lightning.—During a severe electrical storm at Birmingham, Ala., recently, a bolt of lightning struck the Magella substation of the Alabama Power Company, causing an explosion, with the result that the city was without light or power for two hours during the evening peak load. Following the storm the company announced that work would soon be under way on the construction of a transmission line to connect with the lines of the Birmingham Railway, Light & Power Company. Half of the electrical supply of the cit will be carried over the new line, greatly lessening the danger of interruption by lightning.

Middle West Utilities Expands.—The Middle West Utilities Company has acquired four utility companies in northern Indiana. They are the Hawks Electric Company, the Middlebury Electric Company and the Electric Transmission Company of Northern Indiana, all having headquarters at Goshen, Ind., and the Winona Electric Light & Water Company of Warsaw, Ind. These companies serve Goshen, Warsaw, Winona Lake, Nappanee, Bremen and fifty-five smaller communities with electrical service. The combined properties have 6,004 electric customers, and the annual gross earnings are approximately $425,000. The properties will be operated by the Interstate Public Service Company, a Middle West subsidiary.

Power Development of Deschutes River Favored.—Utilization of the Deschutes River, Oregon, and its tributaries for irrigation of approximately 14,000 acres in the Deschutes basin, with incidental power development, has been recommended to the Federal Power Commission by the board of engineers which has been investigating the project. The board began more than a year ago to work out a policy to be followed by the federal government and the State of Oregon in using, reserving or disposing of public lands, waters, reservoirs and power sites contiguous to the Deschutes River. By using the upper Deschutes for irrigation an aggregate of 555,000 hp. could be developed on the lower river, according to the report of the board, and if the upper Deschutes storage be used for power, the aggregate horsepower would be increased to 613,000.

National Personnel Association.—An association with this name has been organized at New York and includes prominent engineers among its directors. According to official announcement, the new organization, which takes over the activities of the National Association of Corporation Training and the Industrial Relations Association of America, will aid business executives in solving problems of personnel administration. Co-operative research will be conducted on a nation-wide scale, and close relations will be established with colleges and universities in carrying out an extensive educational program.

Electric Rates Cut 10 per Cent in San Diego.—The California Railroad Commission has ordered a reduction of approximately 10 per cent in the electric rates of the San Diego Consolidated Gas & Electric Company, based on a drop of about $1 a barrel in the price of oil since rates were fixed in March, 1921. The reduction affects domestic, industrial and agricultural tariffs and brings residence and commercial rates within 10 per cent of pre-war levels. Power rates will be virtually equal to those in effect in 1919. The top lighting rate is reduced in San Diego and vicinity from 9 cents to 8 cents and in Escondido from 11 cents to 9 cents per kilowatt-hour. No reduction is made in street-lighting rates, which were not advanced above pre-war prices, while sign and display lighting rates remain as at present, owing to a previous reduction. Minimum bills are not reduced. Thirty thousand customers are affected.

Hydraulic Laboratory Would Aid Water Power.—Although in the advocacy of the proposed National Hydraulic Laboratory now attracting attention in Washington and indorsed by the Federated American Engineering Societies chief stress is laid on the problem of flood control and of scientific construction of irrigation conduits, John R. Freeman, the prominent engineer who first proposed that the government establish such a laboratory, is convinced that the experiments will be useful to engineers engaged in water-power development by giving them more precise data and coefficients for computing the cubic feet of water per second discharged at various depths over a given form of dam crest. There is also great need, Mr. Freeman points out, for more information as to the absorption of energy in the discharge of spillways or dam overfalls or from sluiceway gates. "Although American engineers have developed the boldest hydraulic structures for water-power development and municipal water supply that can be found in the world," Mr. Freeman says in a preliminary report submitted to the Senate committee, "they have been compelled to base designs largely upon formulas known to be lacking in precision and therefore have had to use larger factors of safety than might otherwise have been necessary."

Associations and Societies

Oklahoma City to Have Two Conventions.—Oklahoma City has been selected as the place for the convention of the Southwestern Geographic Division of the N. E. L. A. to be held in March, 1923. In the same week the Oklahoma Utilities Association will hold its fifth annual convention in that city.

Institute of Radio Engineers.—A paper on "Vacuum Tubes" will be presented by F. S. McCullough of the Westinghouse Electric & Manufacturing Company at the next meeting of the Institute of Radio Engineers on Wednesday, Sept. 6, at 8:15 p. m., in the Engineering Societies Building, New York City.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Conference of Local Electrical Leagues — Association Island, N. Y., Sept. 5-7.

N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 11-13; Southeastern, Atlanta, Sept. 12-15; Great Lakes, French Lick Springs, Ind., Sept. 27-30.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.

Colorado Electric Light, Power and Railway Association—Glenwood Springs, Col., Sept. 11-13.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

Pennsylvania State Association of Electrical Contractors and Dealers—Philadelphia, Sept. 13-14.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 19-22. Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington.

American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

National Association of Railway and Utility Commissioners—Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

Telephone Pioneers of America—Cleveland, Sept. 29-30.

American Electric Railway Association — Chicago, Oct. 2-6. J W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.

Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.

Association of Edison Illuminating Companies — White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.

Public Utilities Association of West Virginia—Charleston, W. Va. Oct. 13-14.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Ontario Association of Electrical Contractors and Dealers—Toronto. Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

Commission Rulings

City Cannot Levy Taxes to Pay for Energy Furnished to Part of Community Only.—A contract entered into by the city of Gary and the Gary Heat, Light & Water Company by which the company agrees to furnish electrical energy to the city at stipulated rates has been approved by the Indiana Public Service Commission with the exception of one clause under the provisions of which the city would be required to levy taxes to pay for energy purchased by it and resold to consumers in a particular district. This provision the commission held to be illegal.

Discrimination Not Involved in Lowering Rates Through Combining Departments of Company.—The Arizona Corporation Commission, which allowed a combination of gas and electric property valuations of the Central Arizona Light & Power Company at Phoenix in order to make possible a lower gas rate in that city, the gas department not being self-sustaining, has decided that in approving higher gas rates for the same company in Tempe —which city the company was unwilling to serve unless the rates were made compensatory as they stood—it has not indorsed a discriminatory tariff.

Security Issues for Interstate Utility.—In granting an application from the Connecticut River Power Company for authority to issue stock the New Hampshire Public Service Commission said: "The whole of a proposed stock issue of an interstate electrical company may be considered when expenditures have been actually made in the acquisition or improvement of plants partly within and partly without the State of New Hampshire in such a way that it is more convenient to pass upon the propriety of the entire expenditure than to determine the portion which should be allocated to New Hampshire, although no authority from the commission is necessary to issue securities for capital expenditures outside of the state."

Rural Service and Rates.—In the course of a complaint made by the city of Canby, Ore., against the Molalla Electric Company and the drawing up of a new rate tariff for that company by the Oregon Public Service Commission, question was raised concerning the company's rural service. The evidence showed that the company's system is largely overbuilt in the agricultural communities and embraces large areas of sparsely settled territory. The commission held that the burden resulting from such improvident capital investment must fall upon the company and not upon the consumers generally. Realizing that the rural rates now effective do not provide an adequate return, the commission held, none the less, that a rate must not exceed the value of the service, or be so high that present consumers will be forced to discontinue or materially curtail the service. Variations in voltage on the rural lines were also complained of, and the commission ordered the company to follow the prescribed rules governing standards of quality, pressure and other service conditions.

Separate Departments of Municipal Plant Should Bear Their Own Costs.—Denying an application of the city of Kaukauna for authority to increase its rates in the village of Little Chute, the Wisconsin Railroad Commission said that electrical consumers of a municipal plant should not be required to carry the burden of a water department which operates at a loss and that a municipal plant earning a surplus above 8 per cent should not be authorized to increase rates in a neighboring village, although the cost of service may be greater in the village, if there is no evidence to indicate that such additional cost is great enough to justify an increase of rates.

One Utility Department Must Not Be Burdened to Support Another One.—A contention of users of water for irrigation who complained against the rates of the Sierra & San Francisco Power Company, contending that the electric and water systems of that company should be considered as a unit for rate-fixing purposes, was thus answered by the California Railroad Commission: "The commission is called upon to establish fair and proper rates for various classes of utility service, among which are rates for electricity. In establishing such electric rates it is the commission's duty and endeavor to adopt only those rates which yield a fair or reasonable return upon the property used in affording the service. To allow a rate which produced not only a reasonable profit upon the electric properties but an amount additional which would overcome a deficit accruing in another and separate department of the utility's activities would result in burdening one class of consumers at the expense of another."

"Going-Concern" Value of Electric Plant.—In determining the sum to be paid by the city of Oroville, Cal., for the electric distribution system of the Pacific Gas & Electric Company contained in Oroville and adjacent territory, the California Railroad Commission rejected the "going-concern" estimate presented by the company, which was based upon the profitableness of the enterprise and also the cost of developing the business. The commission did, however, make an allowance for going-concern value, following the method adopted in the Redding case—that of allowing 2 per cent per annum, the difference between the normal return of 8 per cent and a minimum return of 6 per cent, during the assumed development period of the enterprise. The commission concluded that two years would be a sufficient length of time to attach to the Oroville electric plant such business as in fact was attached to it on Aug. 15, 1918, the date of the filing of the application, and that this method would result in a 4 per cent increase in plant value.

Recent Court Decisions

Company Not Bound by Rates Published When Higher Rates Were Subsequently Approved by Voters.—The Supreme Court of Michigan has affirmed the finding of the Superior Court of Grand Rapids (see *Electrical World*, Sept. 17, 1921, page 588) in a suit brought by that city against the Consumers' Power Company to enforce rates advertised by the company in 1907 and afterward put in force despite the subsequent approval by the voters of an ordinance passed just previously to the advertisement and granting higher rates. The company claimed the right to change to these higher rates, and the courts have sustained its contentions, pointing out that the advertisement did not state how long the lower rates were to continue, that they were never formally approved by the city authorities, and that subsequent ordinances increasing rates (afterward repealed) showed that the advertised prices had no recognized character of permanency. (188 N. W. 530.)*

Contributory Negligence a Question for Jury.—Evidence in Bailey vs. Fort Smith Light & Traction Company, a suit for damages for the death of a lineman employed by a company purchasing energy from the defendant, tended to show that the victim had neglected to observe the safety measures prescribed by the company employing him, including the use of ground chains, but had instead telephoned to the Fort Smith company's generating plant and asked to have the current turned off while he worked on certain transmission lines; that this was done, but that, in violation of the lineman's request, the current was turned on again before he had finished his work, thus causing him to lose his life by contact with an energized wire. The point was made that the deceased was not an employee of the company sued and received no instructions from it as to the method in which he should do his work, but was led to infer that his own instructions to the plant engineer would be observed. The Supreme Court of Arkansas held that instructions to the jury that contributory negligence was established had been rightly refused by the trial court and that the jury had the right to decide otherwise (241 S. W. 42).

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

C. C. Pratt Elected Chairman Utah Section, A.I.E.E.

Chester C. Pratt, Utah plant superintendent of the Mountain States Telephone & Telegraph Company, was recently elected chairman of the Utah Section of the American Institute of Electrical Engineers. Mr. Pratt, who was born in Salt Lake City March 4, 1882, and received his education in the public schools of that city, has been associated with the Mountain States Telephone & Telegraph Company and its predecessor, the Rocky Mountain Bell Telephone Company, for twenty-two years. He first entered the employ of the latter company as a collector in 1900 and through diligent effort and study has advanced step by step to his present position. He is exceedingly well versed in all matters pertaining to the telephone business and is in close touch with electrical affairs in general.

C. C. PRATT

Colonel Byllesby Receives Distinguished Service Medal

Presentation of the United States distinguished service medal was made at the Chicago Club on Aug. 21 to Col. H. M. Byllesby of H. M. Byllesby & Company by Major-General George Bell, Jr., commanding the Sixth Corps area. The citation reads as follows:

"Henry M. Byllesby, then lieutenant-colonel, Signal Corps. For exceptionally meritorious and distinguished services. As general purchasing agent for the American Expeditionary Forces at Base Section No. 3, in Great Britain, from May to December, 1918, he displayed great energy, a comprehensive knowledge of large business affairs and executive ability of the highest order. By this broad experience, foresight and splendid ability to co-operate with representatives of our allies, he solved many difficult problems of fuel supply with conspicuous success and in a manner which insured at critical times a plentiful supply of coal both for our transport service and our troops in France, thereby rendering services of great value to the American Expeditionary Forces."

The British government conferred the distinguished service order on Colonel Byllesby in 1919.

John W. Lieb Again Decorated by Italian King

Another decoration has been conferred upon John W. Lieb, vice-president of the New York Edison Company and past-president of the N. E. L. A. and the A. I. E. E., by the King of Italy, who has made him a Knight Grand Officer of the Crown of Italy. Mr. Lieb had already been made Knight Commander of the Crown of Italy for his work in connection with the installation of electric trolley systems and the introduction of electric light and power service throughout Italy when he was technical manager of the Italian Edison Company at Milan from 1883 to 1894.

The insignia of the new decoration are to be presented to Mr. Lieb by the Italian government through the diplomatic channels.

J. G. G. Kerry, a consulting engineer of Toronto, has been retained by the City Council of Vancouver, B. C., in connection with a survey of sites suitable for a municipal hydro-electric plant.

C. W. Stokes has resigned as manager of the English Electric Company in Montreal to engage in business. Mr. Stokes has had a wide and varied experience in his twelve years' association with the English Electric Company and the Siemens Company of Canada.

Ernest V. Pannell, who is associated with the British Aluminium Company as a consulting engineer for transmission line construction, is at present in Japan. In view of the prevailing activity in water-power development in that country he will probably make an extended stay.

A. E. Hatley has been appointed purchasing agent for the Eastern Texas Electric Company. H. C. Morrow, who formerly held the position, has gone into business for himself. Mr. Hatley was formerly in the transportation department of the Houston Electric Company.

A. P. M. Fleming Returns to England

A. P. M. Fleming, C. B. E., manager of the research and educational department of the Metropolitan-Vickers Electrical Company, England, has recently sailed for that country after spending several weeks in America. Mr. Fleming represented England at the convention of the A. I. E. E. at Niagara Falls. He visited electrical manufacturing establishments while here and obtained first-hand information on manufacturing and educational conditions.

A. P. M. FLEMING

"We have learned many valuable lessons from the radio broadcasting experience of the United States," said Mr. Fleming. In England government control will be used to prohibit interference and to establish co-operation between stations. It is thought that eight 1½-kw. stations will be established for broadcasting purposes. Mr. Fleming was much interested in radio development in this country, and his researches will be very influential in establishing regulatory rules in Great Britain.

Mr. Fleming received his technical training at Finsbury Technical College and then had a wide and varied experience in England and in the United States. He is a specialist on insulation and was manager of the Metropolitan-Vickers transformer department for many years. Recently he has become interested in educational and training courses.

Harold Cole has been appointed distribution engineer for the Detroit Edison Company. After being graduated from Cornell in 1916 Mr. Cole was assistant to P. O. Reyneau, formerly assistant electrical engineer of the Detroit Edison Company.

T. F. Keefe, formerly division superintendent of the Mineral Point Public Service Company, has resigned his position with that company to be associated in the management of the electric and gas utilities of the Wisconsin Power, Light & Heat Company at Baraboo.

Westinghouse International Officer Leaves for South America

J. H. Payne, supervisor of agencies of the Westinghouse Electric International Company, sailed recently from New York for South America. Mr. Payne will spend several months in that continent making a survey of business conditions there and endeavoring to cement further the business ties existing between the Westinghouse company and its customers in South America. On his trip Mr. Payne will visit Brazil, Argentina, Chile and Peru,

J. H. PAYNE

spending about a month in each of these countries. During his stay in South America he will make his headquarters in the cities in which the Westinghouse Electric International Company's offices are situated.

Keith A. Wood Heads New Cowan Truck Department

Keith A. Wood has been appointed head of a new division of material handling just established by the Cowan Truck Company. Mr. Wood was born in West Medford, Mass., Aug. 24, 1890, and prepared for college at the Portsmouth (N. H.) High School and Vermont Academy. He was graduated from Dartmouth in 1913, following which he entered the service of the General Electric Company in Lynn, Mass., taking the student engineering and sales engineering courses. From 1916 to 1918 he was sales agent for that company in Chicago, after which he joined the sales force of the Mercury Manufacturing Company, Chicago, having charge of the New England district with headquarters in Boston. In June, 1920, he became a division sales manager for the Cowan Truck Company, and in January, 1921, general sales manager.

In addition to his work at the head of this division of the Cowan company, Mr. Wood, in his capacity as assistant to J. M. Eaton, general manager, will undertake various special missions from time to time.

C. R. Phenicie, vice-president of the Wisconsin Public Service Company, was recently elected a director of the Green Bay Association of Commerce.

Capt. George B. Baldwin, formerly special agent in the new-business department of the Sacramento division of the Pacific Gas & Electric Company, has been transferred to the head office in San Francisco, where he will engage in special promotion and exploitation work.

Owen D. Young, chairman of the board of the General Electric Company, is receiving the sympathy of his friends on account of the death of his son John, age eighteen, at a construction camp on Hood River, Oregon, where the young man was spending his vacation.

H. W. Johonnott, manager of the Beaver Dam Light & Fuel Company for a period of several years, is leaving the utility field to engage in the automobile business. Mr. Johonnott will be succeeded as manager by Harold H. Kirkpatrick of Fox Lake.

Clinton B. Ferguson, for the past eight year sales engineer in the New England district office of the Cutler-Hammer Manufacturing Company, has been transferred to the New York office, where he will continue work along this line. Mr. Ferguson was stationed at the Milwaukee factory of the company for two years before going to Boston. He is well and favorably known in New England electrical circles.

D. C. Griffiths and **D. B. Graze** have opened offices in the Marshall Building, Cleveland, as manufacturers' agents to handle the distribution of electrical material in Ohio for the M. B. Austin Company and Appleton Rubber Company and in parts of the state for the S. H. Couch Company, Inc. Mr. Griffiths has been associated with the M. B. Austin Company for the past three years, covering the same territory, and, realizing the benefits of co-operative effort, has divided his tasks with Mr. Graze, who has been a specialist on power apparatus in this territory for the past nine years.

A. W. Fox Assumes New Position with Johns-Pratt Company

Arthur Ward Fox, formerly secretary and assistant treasurer of the Johns-Pratt Company, Hartford, Conn., has been elected to the office of vice-president and general manager. Mr. Fox has been associated with this company for sixteen years, starting as a clerk

A. W. FOX

and working up through the various departments, becoming assistant treasurer and factory manager and later secretary. He is therefore well qualified to direct and maintain the logical relations between manufacturing and sales that are so essential in the new-business relations of the Johns-Pratt Company. Beginning with the administration of Mr. Fox as vice-president, all Johns-Pratt products will be marketed direct. Mr. Fox will make his office at the factory, Hartford, Conn.

Obituary

Arthur Breese Proal, a civil and electrical engineer, died recently of pneumonia at his home in Nutley, N. J. Mr. Proal was fifty-two years of age and was known as an expert in methods of fuel reclamation. He was a graduate of Stevens Institute of Technology and had been employed on the Panama Canal.

Mark C. Ewing, for many years manager of the Wisconsin Valley Electric Company and a past-president of the Wisconsin Electrical Association, died at Wausau, Wis., on Aug. 11, at the age of fifty-three. Mr. Ewing had been a pioneer in many ways. He was one of the first utility men in Wisconsin to develop the water resources of the state. Fifteen years ago he saw the wisdom of customer ownership of securities and this policy has been followed in his company with much success.

Alven Beveridge, formerly financial representative of the late George W. Westinghouse, died recently after a short illness. Mr. Beveridge started his business career with the old cotton house of Benjamin Noah. Later he entered the banking house of P. W. Gallaudet & Company. While a member of that firm, with Mr. Gallaudet, he was responsible for the building of the bridge over the Hudson River at Poughkeepsie, a vast undertaking in those days. Mr. Beveridge was the financial representative of Mr. Westinghouse for twenty-seven years. He was seventy-four years old.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

A Call for Coal-Handling Equipment

Manufacturers and Engineers Have Allowed Coal Handling to Fall Behind in the Progress of Station Development

BY H. E. BIRCH
R. H. Beaumont Company, Philadelphia.

FOR years coal has been handled in about the same way in power stations. During this time all kinds of improvements have been made in the boiler-room and engine-room equipment. Fire-tube boilers have disappeared along with low-pressure boilers. The turbine has taken the place of the reciprocating engine. High-duty stokers have crowded out the older types. Large central stations are now installing 2,000-hp. boilers and steam-flow meters, and so many changes have come in type and design that the equipment used ten years ago could hardly be recognized. But coal conveyors remain about the same as of yore.

LARGER EQUIPMENT NEEDED

Out of this has developed a really critical situation. The rapid advance in the progress of the art of station building has set up a demand for larger coal and ash handling equipment. Five years ago a plant that could move 100 tons of coal an hour was a big one. Today a capacity of 200 tons or 300 tons an hour is demanded. A track hopper that measured 12x20 ft. used to be a good-sized piece of apparatus, but now the call is for continually increasing capacity, hoppers 20x40 ft. and mechanism that will lift, turn over and dump an entire coal car. But the coal-handling industry is not keeping up with the procession. Manufacturers of conveyors have developed little new apparatus. Naturally the need is becoming greater all the time, and unless something is undertaken to relieve the situation, embarrassment is bound to follow.

The reason why coal-handling practice has lagged is not hard to see. Few engineers are specializing in this work except the men employed by the manufacturers of present equipment. These men know their work and know their opportunity, but they are naturally inclined to promote the utilization of their own product and prone to prolong its use and delay the substitution of new methods and new materials. Consequently the power-station engineer is at a loss for guidance, and while he proceeds intelligently with the development of larger and more concentrated stations of greater and greater power, applying the steadily evolving new standards for electrical equipment, he falls back on the old-established practice for coal handling. Many of the most elaborate stations built in recent years are in reality out of balance.

Men seem to have failed to recognize the importance of this feature of a modern station. This truth is well illustrated by the fact that the recent report of the National Electric Light Association committee on prime movers had but three pages devoted to coal handling, despite the fact that most of the tremendous amount of coal used by the industry is handled mechanically. Because there has been so little activity in the field the subject has been crowded out of mind by the more stirring developments in power-plant design. Yet we have here perhaps the greatest labor problem and the greatest construction problem involved in the building of a plant. For coal handling has great influence on the basic design of the plant, and inadequate facilities have a decided effect on costs and earnings.

ECONOMIES OFFERED

There is great interest at present in the comparative merits of powdered fuel and stokers. Large investments are made to save one-tenth of a mill per kilowatt. A recent report, however, which tabulated the various items of cost among the more important central stations of the country gave the labor cost for handling coal from cars or barges to the boilers at 4 cents a ton in some plants, while in others the cost ran as high as a dollar a ton. Such a variation is enough to make the difference between no profit at all and a reasonable return upon the investment.

In short, it is high time that the subject received more study and more constructive development by the industry, both manufacturers and power-station men. But more than this is needed. Effort must be applied to meeting the needs and demands of the greater stations of the day directly and providing for the still greater requirements that the next five or ten years are going to bring. It is an engineering problem, true, but it must not be left to the engineer alone. For, above all else, it is a commercial problem—one that offers a great opportunity to the manufacturers who will promulgate the idea and provide equipment.

Problem of Meter Repairs

Users Fail to Appreciate Either the Need for Care of These Delicate Instruments or the Cost of Repairs

BY ORVAL SIMPSON
President Jewell Electrical Instrument Company, Chicago

ALTHOUGH the manufacturing side of the electrical instrument business is often attended with hazard and loss, the hardest problem to handle comes after the instrument has left the factory. It is to insure safe and careful treatment for the instrument at the hands of employees or customers. It certainly is unreasonable to expect an instrument to maintain its accuracy within one-tenth or even one-fourth or one-half of 1 per cent when an operator insists on slamming or throwing it on a table, bench or shelf. An instrument operating under such a range should be handled with mittens. Without extreme care proportioned to its delicacy an instrument cannot be expected to maintain adequate control of a circuit.

Just how the manufacturer can educate and instruct the users of meters in how to take care of them

properly is a puzzle that still requires much thought. Upon examining many groups of instruments returned for repairs, it has been found that in more cases than one the fault was not in the instrument. It was caused by the rough treatment and careless handling given it by some unskilled or careless operator. The mere dropping of a meter is oftentimes enough to blunt the pivots and necessitate its being sent back to the factory. It seems ironical to think of the care and attention given to many other kinds of equipment compared with the little consideration given to a single instrument the lack of which might remove an entire expensive equipment from operation.

One way to counteract this evil might be to have central-station managers distribute literature on the care of measuring instruments to their employees—especially to the newcomers. Many companies are more than willing to do so. To find out whether employees had profited by these instruction books, all that would be necessary would be to observe them casually while using the instrument. Any one seen using an instrument as if it were a sledge hammer should be taken aside and made acquainted with the fact that an instrument is a tool of precision and not a piece of junk. Manuals could also be distributed among university men in technical schools and men in meter-testing schools.

THE HIGH COST OF REPAIRS

At some time or other most central-station men have protested against seemingly excessive charges for meter repairs, but it is not hard to explain the large expense entailed. In training men to make accurate measuring instruments much time is required. To manufacture and assemble some of the most delicate movements requires a man absolutely reliable and trustworthy. When a meter is sent in for repairs it cannot be given to an apprentice; it must go to the most highly trained man in the factory. This, of course, takes him off his regular production. He has to look the instrument over very carefully and determine just what is wrong. Then, if possible, he is required to give an estimate of the cost of the repairs, which is sometimes greater than the cost of a new instrument, since his time and materials must be included in the final estimate.

This is one reason why the repair bills are generally higher than were expected. It affords a most practical argument in favor of proper care of the meter in the customer's hands.

The repair department offers the most difficult problems which the meter manufacturer is called upon to face, for we are required to repair all types and these instruments arrive in all degrees and stages of damage. Practically every returned meter also represents some larger and more expensive equipment or apparatus, out of service as a result of a damaged instrument of comparatively small value.

Then, too, the demand for repairs invariably comes for instant work, with its resultant problem of scheduling production and balancing the payroll in the repair department so as to render prompt service. Unfortunately the manufacturer has no control over the peak demand for repairs. This factor further increases the repair costs.

Survey of Business Conditions

Electric Truck Manufacturer Is Having Best Business Sales

Electric truck manufacturers almost without exception are enthusiastic regarding the possibilities for business developing in line with the increase of transportation by electric vehicles throughout the country. A leading maker of electric trucks reports the best sales for 1922 in the history of the business, and this statement finds an echo with several other manufacturers.

Flexible Armored Conductor Shows Much Activity

A survey of the market for flexible armored conductor shows a condition more or less usual in the electrical field, practically all manufacturers reporting close-to-capacity business. At least one manufacturer has given up production of the larger sizes in order that he may devote all his capacity to the smaller sizes, for which demand has been very good.

French Showing Great Interest in Utilization of Electricity

The critical shortage of coal during the war and the period immediately following has resulted in an awakening of public opinion to the possibilities and the economy of electrical power, says Consul Paul H. Cram, Nancy, France, reporting to the Department of Commerce. The presence of abundant undeveloped hydraulic power, the permanent dependence on foreign coal and the unfavorable economic situation of the country are factors which will doubtless continue for a long period to guide public policy and to encourage private initiative toward a greater utilization of electricity.

The French government has not only given its moral support in favor of a more intensive use of electricity but has also aided materially by the construction of lines for the distribution of power. In fact, the government advocates the construction of such lines as may be necessary to connect the important centers of hydraulic production, such as the Alps, the Pyrenees, Auvergne, the projected centers involving the harnessing up of the Rhone and Rhine rivers and the tidal force in Brittany, with the steam-power centers of Paris, Lorraine and northern France.

More Electrical Devices Cause Less Drudgery in Canada

The increase in demand for labor-saving devices throughout Canada and the opportunity afforded for further introduction of this line of American goods finds interesting confirmation in certain facts brought out by the latest Canadian census.

During the last ten years cooks have decreased in number 21½ per cent, chambermaids 26 per cent, housemaids 20 per cent, home laundry workers 25 per cent, and home dressmakers 47½ per cent. These figures have significance for the adoption of labor-saving machinery in the home and the curtailment of drudgery incident to housekeeping.

Evidence of increased production of household electrical devices in Canada is also significant, this increase being in direct proportion to the decrease of domestic employees above noted. A marked increase is found during the years in question in the number of mechanical engineers, machinists and technical engineers, a fairly large percentage of whom are engaged in making home appliances.

Prevailing Conditions Affecting Cost and Volume

Freight-Loading Gains.—Loading of revenue freight on the railroads of the country totaled 852,580 cars during the week ended Aug. 12, which was an increase of 1,229 cars compared with the preceding week, according to reports just filed by the carriers with the American Railway Association. This was an increase of 44,311 cars over the correcponding week in 1921, but a decrease of 18,689 cars compared with the corresponding week in 1920. Coal

loadings during the week totaled 84,559 cars, an increase of 5,313 over the previous week. This was, however, a decrease of 72,332 cars compared with the same week last year and a decrease of 137,285 cars compared with the same week two years ago.

Bank Clearings Gain 19.3 per Cent.—A further widening of the margin of increase in bank clearings over last year's figures is noted this week, an aggregate of $5,625,187,000 at twenty cities in the United States, as reported to *Dun's Review*, being 19.3 per cent in excess of the $4,714,087,062 of this period of 1921. This week's total, however, is 13.1 per cent less than the $6,471,151,591 of two years ago.

Failures Decrease.—This week all sections of the United States, especially the South and West, showed decreases in the number of failures reported to R. G. Dun & Company, so that the total, 348, was much less than that of the previous week, which was 415, and almost down to the level of the corresponding week in 1921, when 339 defaults were reported. A distinct decline was also to be noted in the number of insolvencies with liabilities of $5,000 or more in each case, which totaled 190 this week, as compared with 235 in the previous week, while the smaller figure was 54.6 per cent of the total, as against 56.6 last week. For the corresponding period last year, defaults aggregated 163, a percentage of 49.8.

Spain Reduces Duties on Our Electric Machinery

Electric locomotives and self-propelled vehicles, electric machinery and installations weighing over 1,000 kg., made in America, are now accepted in Spain at reduced duties, according to the Department of Commerce. The report states:

"Owing to the conflicting interpretations on the part of the Spanish customs officials as to the application of the concessions granted to France to similar products of other countries, a definite ruling from the Spanish Minister of Finance was informally requested by Commercial Attaché Cunningham, working in co-operation with the embassy, and the present order appears to give assurance that American products will continue to enjoy the most-favored-nation treatment which they have thus far been accorded in Spain.

"The reductions in the Spanish duties were granted in return for varying concessions from the French general duties accorded to certain characteristic Spanish products, particularly wines. American products have not for some time enjoyed most-favored-nation treatment in France, and in view of the fact that the present concessions in French duties granted to Spain are not below those minimum rates which had already been accorded by France to a number of other countries, no new handicap upon American products is being imposed and no list of the particular commodities affected seems necessary."

Motor Sales Gradually Increasing

One Factory Shows Gain of 25 per Cent in Business—Deliveries Are Still Satisfactory—Prices Are Highly Competitive

ELECTRIC motors under 25 hp. in rating have been selling better during the last few months than a year ago, and while existing manufacturing facilities are far from overtaxed, the producers of such equipment are facing a real problem in anticipation of business expansion this fall. Last week's motor sales in one factory in excellent touch with conditions throughout the country were about 25 per cent above those of the same week last year, and this notwithstanding a perceptible and probably temporary falling off of demand attributed to disturbed labor conditions in transportation and mining circles. The market for motors is extremely diversified and widely distributed geographically and industrially. At present great interest is apparent in the machine-tool industry in the design of unified machine and motor equipment, and there is also intense activity in the laundry trade along the line of individual motor driving. This demand for special motors suited to the particular requirements of machinery developed for highly specialized industries is a striking feature of the market. It carries with it certain serious problems in its effect upon the economical production of standard motors, but is looked upon by progressive manufacturers as a necessary part of the extension of electrification to industry in general.

Motor deliveries are still satisfactory, but considerable difficulty is being experienced in the securing of raw materials, especially steel. Expected shipments have been canceled or badly delayed in not a few cases, and this situation is causing motor manufacturers to look very sharply into their stocks of insulation, magnetic steel, etc., since the war-time stocks of material procured at high prices have now been pretty thoroughly liquidated. In anticipation of increased demand for motors this fall, factories equipped for this class of production are being "tuned up" for early service or put into active operation. There is also a scarcity of high-grade labor for motor manufacturing in some quarters, and the demands of some purchasers for special motors built along lines of greater accuracy than hitherto are absorbing the best quality of labor.

Motor prices are highly competitive at this time, and in some circles it is stated that manufacturers here and there are offering motors at quotations which do not represent adequate consideration of overhead charges above factory costs. It is questioned whether a more general study of overhead would not be the wisest move motor manufacturers could make at this time. The scattered and highly technical demands made upon motor sales forces have increased the cost of marketing this class of equipment very decidedly, and it is felt that overhead is being badly underestimated, to say the least, in many cases of close competition for sales. The seriousness of this matter is recognized by many men in the motor field, but the tendency of others to shut their eyes to it is dangerous. According to well-informed opinion, the outlook for the fall trade in motors is excellent, given more stabilized price and labor conditions throughout the country.

While the sale of standard motors is improving slowly from month to month, the demand for special equipments to meet the requirements of machine-tool and other designers is a marked tendency at present in manufacturing circles. To a representative of the *Electrical World* a prominent motor manufacturer stated recently that this tendency is inevitable with progress in motor applications, although it interferes materially with mass production of regular lines and types. It is no exaggeration to state that in many cases two standard motors can now be built at the cost of one special motor in a well-organized factory. For this reason it is felt to be important in motor factories to undertake such work only after careful analyses of the machinery-driving problem involved, and the cost of maintaining qualified staffs to deal with these problems and maintain close contact with the builders of the specialized machinery that is used in different industries is by no means small.

Better Service Given

Manufacturers of machine tools, laundry machinery and other power-using equipment are no longer content in more progressive circles to build such machines for driving by externally applied motors picked up here and there as the consumer may find opportunity. The power cycles of the machines have been analyzed at great length on the basis of experience and exhausive tests, and motor requirements are now scientifically determined in a great number of cases which formerly would have been left to the hurried "cut-and-dry" method of "home-made" driving installations. A manufacturer of shoe machinery has developed individual drive within the last few years for over 100 machines, and more than 3,000 such machines from this one house are now in service. Many more are in process of development. This tendency illustrates the breadth of the motor market, and at the same time the field of service for standard motors is widening, especially in connection with the electrification of existing installations and the powering of machinery for ordinary service involving no unusual torque or speed characteristics. This increased precision of motor application, it is believed, represents potential gains of large magnitude both in the investment and operating phases of electric power application.

Good Prospects for Heater Sales During 1922 and 1923

Prospects for heater sales during the season of 1922 to 1923 reveal many interesting factors. From present indications there will be a shortage of coal, which should help demand. Some sections of the country where natural gas is used as fuel report a scarcity of that too. Furthermore, a great deal of publicity and intensive selling has been carried on in pushing heater sales since last winter's buying. Production of heaters has been proceeding smoothly, with a good and more sufficient supply of labor available. Raw-material shortages have been naturally overcome, and though some complaint is still heard regarding such items as porcelain, steel, lamp cord and switches, it is in less degree.

Austria's Foreign Trade in Electrical Products Gains

Detailed statistics have been issued by the English government respecting the foreign trade of Austria in electrical manufactures in the first half of the year 1921. The figures are as follows, those for the corresponding period of 1920 being given for the purpose of comparison:

	First Half of 1920 Metric Tons	First Half of 1921 Metric Tons
IMPORTS:		
Dynamos and electric motors (except automobile motors)	247	459
Meters, etc	20	66
Switches, contacts, etc	86	131
Electric bulbs, etc	66	173
Other electrical apparatus	143	177
Cables and insulated wires	23	29
Carbons for electrotechnical purposes	45	28
Other classes not specified	2	3
Total	643	1,070
EXPORTS:		
Dynamos, electric motors (except automobile motors) and transformers	868	2,283
Telephones and microphones	24	189
Meters	30	93
Switches and contacts, etc.	68	144
Electric bulbs, etc	352	674
Other electrical apparatus	385	1,053
Cables and insulated wires	230	541
Accumulators, with lead plates, and plates alone	293	366
Carbons for electrotechnical purposes	64	83
Total	2,317	5,430

Little Interest in Radio Shown in Sweden

Owing to government regulations nothing has been done so far to stimulate popular interest in amateur radio telephony in Sweden. The use of radio apparatus is controlled by the Royal Telegraph Board. Private firms may use it under license, but up to the present time they have not availed themselves of this right.

Only one Swedish firm is at present manufacturing radio apparatus and parts, and it has supplied considerable quantities to the Swedish government. The factory is comparatively small, and arrangements have been made for its expansion should circumstances warrant. The apparatus imported into Sweden is mostly of German make.

Swedish electrical dealers have for some time been trying to obtain modification of the regulation which forbids the use of radio apparatus by amateurs, but so far without results.

Says American Cable Facilities Are Being Widened

Communication systems throughout the world were so generally affected by the war that the traffic handled on every route in operation after the armistice was greatly in excess of any previous record, says P. E. Nagle, communications expert of the Department of Commerce. This increased traffic, he states, was partly due to the suspension of service on such important communication routes as the Indo-European Telegraph Company, the Great Northern Telegraph Company and the various German and German-Dutch cables, and the officials of American companies were generally of the opinion that with the restoration of service on the routes mentioned there would be a noticeable falling off in the volume of messages handled by American companies. Events, however, according to Mr. Nagle, did not bear out this view, and at the present date American cable and radio companies are handling more traffic than they ever did except during the war and the two years immediately following the armistice.

"The result of this steady growth in traffic," Mr. Nagle says, "has been to keep up the interest in plans for new cables and new radio stations, and every American communication company is now actively engaged in the construction of additional facilities and in plans for new routes and methods for the improvement of operating conditions."

Slight Improvement in Porcelain Sales Reported

"Porcelain sales during the past six months have slightly improved," is the report of a leading manufacturer of porcelain. "Deliveries are prompt, except occasionally for a complaint of lack of proper coal supply.

"Prices are at their low-water mark. There is every possibility of a slight change to higher figures, if not immediately, in the near future. We believe the next half year will be better than the last, that the lowest ebb in the market has been reached and that we are now on the upward turn. Our sales indicate increasing business and inquiries are more numerous."

Says Constantinople Homes Need Heating Devices

Two gas companies which operated in Constantinople in pre-war days have not yet resumed service, and this fact, combined with proposed special rates for electric heating, should result in the broader use in that city of electric radiators and, to some extent, of electric ranges and smaller cooking devices, according to reports to the Department of Commerce.

Welding Devices Sales Rapidly Increasing

"Current sales in welding devices are two to three times as good as six months ago, and we have no idea what is causing the improvement. In fact, with strikes and other disturbing conditions, we would predict the opposite result," says a leading manufacturer. "Deliveries are good enough, but we are trying to stock up. We have changed our prices downward in the last six months."

Metal Market Situation

Copper Trading Dull—Curtailment of Output—Statistical Positions Strengthened Greatly

Trading in the copper market last week was dull, but in view of present conditions demand from domestic interests was fair. The strikes have interfered considerably with production of refined metal, and the movement into consuming channels also has suffered from the same causes.

This curtailment of output, however, is strengthening the statistical position of the market greatly. Electrolytic copper is held for 14 cents, and even at this figure offerings have been scaled down to a small point.

Foreign buying continues at the rate of about 2,000,000 lb. daily, and exports from New York City since Aug. 1 totaled 11,267 tons. A feature of the present movement is the heavier shipments to England, as the first seven months of the year the demand from that country was extremely limited.

There is a fair demand for copper wire, particularly from magneto manufacturers, who are doing a splendid business with the automotive industry. Public utilities are buying increasing quantities of copper material.

Undoubtedly a large amount of copper remains to be bought by wire and brass mills during the next few weeks, but they are waiting for a clearing of the domestic situation before making further commitments of importance. During the last week or so the rail and coal situation has tended to decrease placing of orders by ultimate consumers. Prior to that consumers' orders were unusually good for more than a month. Much of the metal to cover these orders remains to be bought.

NEW YORK METAL MARKET PRICES

	Aug. 23, 1922 Cents per Pound	Aug. 30, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14.00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

Three Porphyry Copper Firms Report Losses for 1922

The reports of the four porphyry copper companies for the second quarter of 1922, after a shutdown of twelve months from April 1, 1921, to April 1 last, show three of the companies operating at a loss. However, the Utah Copper Company, the fourth and largest of the group, reported a comparatively small profit from production.

The Utah Copper's report for the quarter ended June 30, 1922, showed total income of $704,158, equal to 43 cents a share (par $10) on $16,244,900 capital stock, contrasted with a deficit of $444,229 in the corresponding quarter last year.

The Chino Copper Company reported a deficit of $126,131 for the quarter compared with a deficit of $304,608 in the same three months of 1921. Its gross production of copper aggregated 6,898,030 lb.

The Ray Consolidated also reported a deficit totaling $247,867, compared with a deficit of $370,209 a year previous, the deficit from operations being cut down to the former figure by $64,202 in miscellaneous income. Its gross copper production totaled 5,772,527 lb.

Nevada Consolidated reported an operating loss of $103,308 figured on a basis of 13.209 cents a pound. Shutdown expenses and miscellaneous nonoperating costs brought the total loss to $234,218.

Reports Amateur Radio Work in Germany Restricted

German manufacturers of radio apparatus and equipment are not in a position to make extensive deliveries of their product, according to Vice-Consul Nathaniel B. Davis, Berlin, in a report to the Department of Commerce. This is due to the fact that up to the present time the demand has not been sufficiently great to warrant the manufacture of radio instruments in large quantities.

"Amateur radio work is not popular in Germany," Mr. Davis reports, "and stations are not numerous. Radio telephony in particular is almost an unknown science except to engineers, professional operators and experimenters.

"The principal reasons given for the lack of interest in radio on the part of the general public are that amateur stations are a luxury beyond the means of the average German, under present economic conditions, and official restrictions on their use.

"All radio communication in Germany is under the control of the Federal Post Office Department, which operates the commercial stations. Private installations must ordinarily be made by the department but in exceptional cases private companies or individuals may be authorized to erect their own plants, but they must first obtain a license from the Post Office Department. The fee for such a license varies according to the size of the plan, with a maximum of 2,000 marks per annum.

"At present only one station in Berlin is licensed to broadcast. This station broadcasts market and exchange quotations. Subscribers to the service are permitted to install receiving stations upon payment of the license fee and the monthly subscription rates, which vary at present from 1,000 marks to 7,500 marks according to the class of subscription. Subscribers may rent receiving sets from the Post Office Department for 2,500 marks per month if they do not desire to build their own.

"A similar service for broadcasting news items is being planned but has not yet been put into operation. The organizers of this service, however, intend to serve provincial newspapers rather than amateurs.

"In spite of the lack of demand for short-wave amateur apparatus there are a number of firms in and about Berlin which manufacture either complete receiving sets or parts. Vacuum tubes are almost unavailable, and practically all receiving sets manufactured in this district operate with crystal detectors."

No Delayed Shipments of Motors in New England

New wiring installations, largely in residences, are creating a fair demand for meters of the more common sizes. Delivery conditions are easy, and the proximity of some representative factories to the New England consumer is a favorable feature under present conditions, although so far no reports of delayed shipments from interior points have come to the attention of the *Electrical World.*

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

MUCH improvement in demand for electrical materials is noted this week. Reports from all over the country indicate that the rail and coal strikers are having a less deadening effect on deliveries and prices. A feature of this week is the slight increase in the price of conduit. This is the third increase in two months. Central-station outputs show healthy gains over last year. Factory production in electric radiators is very active in expectation of a heavy fall demand, a better trade being anticipated owing to the prospective hard-coal shortage. Wire sales are in good volume with prices firm. Improvement in motor sales continues.

New York

Motor Sales Improving—Crystal Decorated Fixtures Active—Interest in Radiators Increasing

Demand in electrical materials shows improvement. Conduit stocks are reported lower than two weeks ago, and prices for this material have advanced slightly during the last few days. Outputs of central stations show large gains over last year. Appliance sales are improving greatly.

Motors.—Sales are improving, the smaller sizes continuing to sell best. Prices are steady and stocks are lower.

Fixtures.—A slight improvement is noted. Better grades continue to sell best. Some calls are noted for the new styles of crystal hangers.

Lamps.—Demand is improving, and the ordinary sizes are selling in greater volume.

Radiators.—Increased interest is being shown following extensive advertising campaigns among the dealers.

Chicago

Conduit Deliveries Are Uncertain—Wire and Lamp Cord Prices Expected to Increase

Nothing of prominence has been reported by the electrical trade this week. Business in general is very good. Because of the increase in demand conduit has gone up three points and deliveries are uncertain on most sizes.

Wire.—Demand continues good. Rubber-covered No. 14 is being quoted at $6.10 to $6.20 per 1,000-ft. in 5,000-ft. lots, and a price increase is expected.

High-Tension Equipment.—In general, business in fuses, lightning arresters and disconnecting switches is very brisk.

Safety Switches.—Business is moving very slowly. The demand for the 30-amp. type is the greatest.

Lamp Cord.—The call for lamp cord is fair. There is an expected increase in present price, which is $15.00 per 1,000 ft. for the No. 18 twisted cotton with 1/64-in. insulation.

Boston

Central-Station Outputs Show Healthy Gains—Water-Heater Sales Improve—Motors Active

Uneven business characterizes the local market in electrical supplies this week. Underlying conditions in New England industry are improving with few exceptions. Railroad transportation is rapidly recovering from the effects of the shopmen's strike, which in this district were never very evident to the public; textile labor is resuming work, building operations are extremely

active, and the outlook is much improved in the soft-coal situation. Central-station outputs show healthy gains over last year. Prices stiffened last week on rigid conduit, and deliveries continue unsatisfactory on this material. Appliance sales are responding to vigorous merchandising efforts.

Flexible Armored Conductor.—Sales are active, with good supplies in hand and firm prices. No. 14, single-strip, in 5,000-ft. lots, is quoted at $48 to $50 per 1,000 ft.

Water Heaters.—Recent sales show improving demand, and a better trade is anticipated this fall owing to hard-coal shortage.

Electric Radiators.—Inquiries of manufacturers reflect increased interest among jobbers as to fall sales. Factory production is very active and stocks are in shape to meet the first autumn rush.

Wire.—Sales are in good volume, with firm prices. Weatherproof base is 17 cents and bare base 16 cents.

Motors.—Improvement continues in sales of smaller sizes, both new and second-hand. Competition is very sharp.

Appliances. — Vacuum cleaners are moving faster, and washing machines are attracting more interest in retail circles. Fans are very quiet. Electric range sales are better than last year's.

Atlanta

Building Slowing Up—Vacuum-Cleaner Stocks Are Satisfactory—Battery-Charging Outfits Are Active

Building activities have slowed up somewhat on account of the difficulty in the receipt of materials of the heavier type. Cement is reported somewhat scarce owing to shutdown of cement plants on account of coal shortage, while embargoes and freight congestion are causing considerable difficulty in receipt of all freight shipments. The coal strike is beginning to be felt, and it is reported that the railroads are confiscating coal in transit intended for utility use. Should this continue, the steam-driven utilities are going to have considerable embarrassment in meeting their customers' demands.

Fans.—Sales have picked up again and jobbers' stocks are reported low. A few small lots are on hand but are going rapidly.

Vacuum Cleaners.—Retailers report little success in interesting prospective customers. Dealers' stocks are ample and factory shipments satisfactory. Prices steady.

High-Tension Transformers. — Shipments have lengthened until deliveries are on a fourteen-week to eighteen-week basis, with the exception of one or two of the smaller manufacturers.

Battery-Charging Outfits. — These show a slightly increased movement but are still much slower than was anticipated.

Dry Batteries.—Fall pick-up has not materialized, but satisfactory sales are anticipated as soon as the harvest season and cool weather begins. Stocks and shipments are satisfactory.

Lamp Cord.—Fair sales are to be noted, with a probable increase for temporary work if fixture shipments continue to be delayed. Jobbers' stocks are sufficient to meet demands.

St. Louis

Slight Business Improvement Reported—Conduit Prices Advance—Safety Switches in Demand

Slight improvement in business seems to have been generally experienced by the jobbers this week. The opening of the mines has started movement of electrical goods to that field. Residential construction continues on a big scale, but costs remain very high and lumber concerns are anticipating a substantial slump in building activity by next year.

Stocks are not particularly affected by railroad difficulties. The only item that is especially short is iron conduit. Prices are firm, with conduit as the principal item showing increase.

Conduit.—With stocks low and deliveries difficult, prices were again raised this week. Revised quotations are as follows: ½-in. black, $55.60 per 1,000 ft.; ½-in. galvanized, $79.60 per 1,000 ft. Demand is firm, with little change from last week.

Wire.—Weatherproof is commanding higher prices, the base price now quoted being 17½ cents per pound. Base price on bare is from 16 cents to 16½ cents per pound. No. 14 rubber-covered sells for $6.50 per 1,000 ft. in 5,000-ft. quantities.

Fuses.—Steady demand and prices, with conservative stocks, are generally found.

Safety Switches.—This type of switch is becoming increasingly popular. Stocks are good and immediate delivery can ordinarily be given. Entrance switches are priced from $1.30 to $2 in standard packages of ten switches. A 30 amp., three-pole motor starter sells for $8.

Cleveland

Radio Market Dull—Washers Active—Ranges in Fair Demand—Refrigerator Prices Steady

Radio Equipment.—Last week's inactivity continues. Express facilities here have prevented the rail controversy from subjecting orders to delay in delivery.

Washers. — Manufacturers report a demand equal to capacity and no price change. Jobbers have met the vacation depression with intensive selling campaigns, and dealers are far from pessimistic.

Ironers and Dishwashers. — Dealers have promoted sales with attractive window displays and demonstrations. The number of inquiries received is regarded as indicative of the existence of a potential field, and jobbers and dealers are planning to capitalize it with selling campaigns.

Ranges.—Fair demand is reported, and dealers are closely following up inquiries with satisfactory results.

Heaters.—The fluctuating barometer here in the past week has been considered responsible for the slight increase in heater sales. Dealers are ordering the small portable type for the fall demand.

Fixtures.—The sudden increase in building and construction has proportionately affected the sale of fixtures, and activity in the better grades indicates that a brisk autumn season may be expected.

Refrigerators.—The general interest in appliances has included refrigerators, and while nothing spectacular in sales is reported, jobbers are expecting to dispose of the present supply without difficulty. The market is plentiful but prices are steady.

San Francisco

Curling Irons Reported Popular—Jobbers Allowing Better Profit Rate on Washers

Heating Appliances. — Curling irons are popular. Small disk stoves are also popular, and dealers in college cities report excellent business. There is a marked tendency of jobbers to give a better rate on washers and larger appliances during 1922. The average washer profit has progressed from 25 per cent to 30 per cent.

Vacuum Cleaners.—Prices are steady. Public demand for all is steadily growing.

Schedule Material.—Huge and steady boat shipments have produced large and well-assorted local stocks.

Salt Lake City–Denver

Conduit Demand Steady—Radio Dealers Expect Improvement—Motor Stock Reported Ample

Aside from an occasional delayed shipment, the strike is having little direct effect on the electrical trade. With producers of perishable crops, however, it is working havoc in many cases. Enough cars cannot be secured to carry ripe fruits to market, the movement of coal to famine centers apparently having the right-of-way.

Employment conditions are good. The general buying power is improving, and the disposition to spend indicates that prices have about reached the point of complete adjustment.

Conduit.—Demand is steady. Prices have recently shown a stiffening tendency. A 5 per cent increase is reported for the last month.

Radio.—Jobbers are preparing for a big jump in demand. Stocks are in good shape. Dealers display only moderate interest. Prices are downward.

Motors.—Fair demand. Stocks ample in all types and sizes.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Large Increase in Wakefield Brass Company's Business

Business in commercial lighting hangers manufactured by the F. W. Wakefield Brass Company, Vermilion, Ohio, increased 94 per cent in the second quarter of 1922 as compared with the first quarter. The company reports that approximately the same rate of growth is still holding good.

American Pole Protective Taken Over by Trust Estate

The American Pole Protective Company, an Illinois corporation, has been taken over by the Appco Trust, Ltd., a common-law trust estate. The estate is to be administered by five trustees. The present trustees are S. M. Mulnix, W. G. Scott, S. A. Nelson, H. C. Heyer and A. L. Slusser.

The transfer was made so as to provide for expansion and development. Under the old organization the Appco pole protector—an appliance made of corrugated galvanized sheet iron which is assembled around the base of a pole for the reinforcement of telephone, telegraph and transmission-line poles at their weakest point, the ground line, and to protect the poles from fire—was patented and improved.

Electric Motor & Engineering Appoints Sales Agents

The Electric Motor & Engineering Company, Canton, Ohio, announces that it has appointed the following sales agents:

The Charles Lakin Sales, 4937 Maplewood Avenue, Detroit; C. M. C. Electric Sales, 507 Odd Fellows Building, Indianapolis, and James R. Jordan, Jr., 217 East Third Street, Cincinnati.

Westinghouse Announces Recent Sales Appointments

Changes affecting the personnel of the Atlanta, Denver, Seattle, New York, San Francisco and New Orleans sales offices have been announced by officials of the Westinghouse Electric & Manufacturing Company.

In the Atlanta office R. H. Moore has been appointed office manager and Thomas Fuller has been made manager of the central-station division and placed in charge of the sale of supply apparatus.

E. C. Means has been appointed manager of the central-station and transportation divisions of the Denver office, and J. P. Sprunt, Jr., has been made manager of the merchandising division which was recently organized there. Mr. Sprunt will also have general charge of the sale of supply apparatus in the Denver territory.

J. G. Miles has been appointed manager of the central station division and has been placed in general charge of the sale of supply apparatus in the Seattle district. A. W. Eshelby has been appointed manager of the transportation division, and A. A. Miller has been made special representative in large negotiations and power developments in the Seattle office.

C. V. Holmes has been appointed district auditor with headquarters in the New York sales office.

Edward C. McCarty has been appointed treasury and accounting representative of the San Francisco office, succeeding A. L. Austin, resigned.

O. P. McCord has been appointed branch manager of the New Orleans office.

National Transformer Company Moves to New Quarters

The National Transformer Manufacturing Company, formerly of 5247 North Clark Street, Chicago, has moved to 154 Whiting Street in that city, officials of that company announce.

The manufacturing floor space was increased 260 per cent, which will facilitate increased production on toaster stoves, special transformers and radio equipment. J. W. Crenerius is president and I. J. Mendels secretary. This firm was recently incorporated for $25,000.

Roebling Company Announces Wage Increase

Following the recent wage increases by the United States Steel Corporation, the John A. Roebling Sons Company, wire and cable manufacturer, Roebling, N. J., announces wage increases for its 6,500 employees. The increase, to take effect Sept. 3, will be about 20 per cent for common labor, with equitable adjustments for other classes.

Morecroft Appointed Engineer of New York Radio Firm

The Jewett Manufacturing Corporation, radio-apparatus manufacturer, with executive offices at 342 Madison Avenue, New York City, announces that it has appointed Professor Morecroft of Columbia University its radio engineer. Professor Morecroft has designed a new vario-coupler which the company is using in all its short-wave sets.

Supply Company Joins with Franklin Electric

The Champion Electric Supply Company has moved to 733 West Jackson Boulevard, Chicago, after being established for three years at 204 West Randolph Street. This company is now controlled by J. L. Cohen, president of the Franklin Electric Company, and the capitalization has been increased to $100,000. Mr. Cohen has brought the Franklin Electric Company, formerly at 63 East Lake Street, to the same address and states that he will manufacture lighting supplies and electrical equipment, while the Champion Electric will serve as distributor and jobber. His floor space has been increased 5,000 sq.ft., and his present capacity is 12,500 sq.ft. The personnel of the Champion Electric Supply Company has not been completed.

Harvest Days and Washing Machines

BY H. M. C.

THE opportunities for selling appliances at agricultural fairs are not realized by all manufacturers. A bumper crop has put a great deal of money in the famers' pockets.

A sales bulletin, as rugged as a field of healthy corn, was issued last week. It tells of wonderful opportunities—selling the product of the Laundryette Manufacturing Company, Cleveland, U. S. A., at agricultural fairs. The story starts directly at the very top of the first page. Whoever wrote it must have experienced many dusty roads, tough prospects and days without sales. Perhaps he is the company's president; he is a salesman.

"The vacation season will be passed, the crops will be in and the fairs will be thronged. . . . Generally speaking, almost anything can be displayed profitably at a fair. They will inspect the best apples produced in their territory just as readily as they will visit the side shows in the Midway. They're in a looking mood and they have money to spend. Brush up on your demonstration talk. It will do no good to show the machine if you can't talk intelligently about it after you have secured attention," are words of the writer. "Remember, if you are a man, that the women you talk to are doing washings each week and they think they know as much about it as you do about tying your tie or shaving yourself."

You see, he warns salesmen to prepare for the selling field.

Harvest days for all. Washing machines are sisters of vacuum cleaners, and irons and toasters cousins of both. All can be sold at these agricultural fairs.

Radio Corporation of America Secures Large Order

The Radio Corporation of America has announced that it has received orders for the building of five radio stations, three for Central America and two for the United States. Each of the stations will have a sending radius of more than 2,000 miles.

The stations will be built for the Tropical Radio Telegraph Company and the United Fruit Company. The three Central American stations will be at the corners of the triangle embracing Honduras, Nicaragua and Panama. The Tropical Radio Telegraph stations will be at Managua, the capital of Nicaragua, and at Tegucigalpa, the capital of Honduras, which has been designated as the capital of the new Central American Union. These stations will connect with the United Fruit Company's station at Almirante, Panama.

Believes America Will Adopt German Standards

Oscar R. Wikander, an American engineer, has just returned from Germany, where he represented the American Engineering Standards Committee of New York City in several conferences regarding various methods of international standardization. German industries have developed many efficient standard systems within the last few years, and he believes the time is not far distant when American manufacturers will receive inquiries from foreign countries asking if they can furnish goods according to the German national standards.

Italian Hydro-Electric Enterprises Financed by Americans

The report is confirmed by the London *Times* "Trade Supplement" that an American financial group has granted a ten-million-dollar credit for certain Italian hydro-electric enterprises. It is said that a corporation is being formed in the United States to issue securities and that extensive preparations have already been made for advertising and selling the bonds. It is said also that this loan is to be the first of a series which will eventually include all of the provincial districts in northern Italy. Future loans will, however, depend on the measure of success achieved in marketing the first issue.

Multiple Storage Battery Firm Appoints Sales Manager

The Multiple Storage Battery Corporation, New York City, manufacturer of "A" and "B" storage "radiobats," has placed R. H. Butler in charge of sales and advertising for its radio division.

Mr. Butler has been associated with the merchandising of radio products for three years. During that time he has been actively connected with several of the most important advertising and selling campaigns in the radio industry.

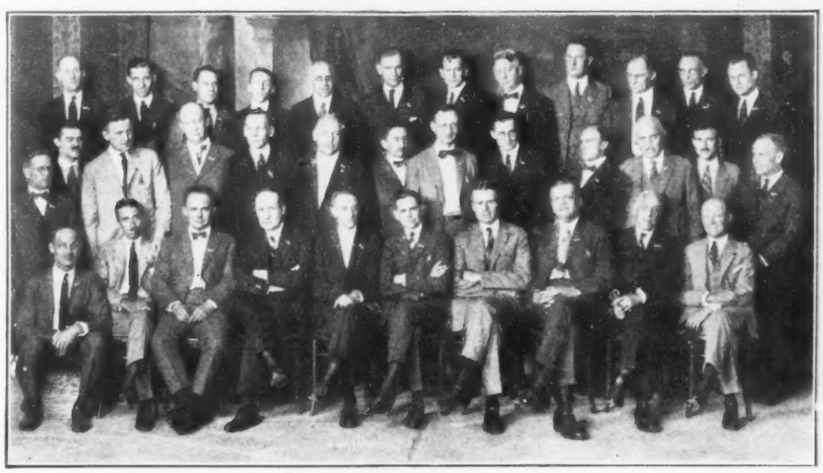
An extensive selling and advertising campaign will be launched by the company this fall, calling for dominating space in leading national magazines and newspapers as well as the radio press. The sale policy will also include the liberal use of selling helps and various forms of sales co-operation for the benefit of the radio dealer.

The newly enlarged plant of the Multiple Storage firm is located at Jamaica, L. I., with a capacity of 5,000 "A" "Radiobats" and 10,000 "B" "radiobats" per week, in addition to the automobile, farm-lighting, aëroplane and other types of batteries for various purposes.

Cooper Hewitt Electric Company Holds Sales Convention

The Cooper Hewitt Electric Company recently held a convention at its factory annex, Eighth and Grand Streets, Hoboken, N. J. The managers and salesmen from all the district sales offices except the Pacific coast, together with the members of the manufacturing, engineering and general office executive forces, were present. After brief addresses by W. A. D. Evans, president, and A. D. Childs, sales manager, a general inspection of the factory was conducted by Messrs. Mailey, Buttolph and Smalley.

The chief object of the convention was to acquaint the selling force with the improvements in manufacturing processes that have been developed and put into production since the company was taken over by the General Electric interests.



SALESMEN AT COOPER HEWITT CONVENTION HELD RECENTLY AT HOBOKEN, N. J.

The Fulton Iron Works, St. Louis, announces that it has been awarded a contract for a three-cylinder 285-boiler-hp. Fulton Diesel to be installed in the municipal light plant at Granite Falls, Minn. This engine is arranged for direct connection to a 190-kw. alternating-current generator with belted exciter.

Associated Engineers, Inc., announces that it has moved to larger quarters at 373 Broadway, Milwaukee.

The Ford Instrument Company, Inc., announces the removal of its offices and factory to its new building, Rawson Street and Nelson Avenue, Long Island City, N. Y., on Aug. 1.

The Millers Falls Paper Company, Millers Falls, Mass., is electrifying its entire plant. Each machine is to be driven by a separate motor. Energy will be supplied from the Franklin Electric Light & Power Company.

The Hartford Instrument Company, Hartford, Conn., has been incorporated under the laws of that state to manufacture electrical, mechanical and optical devices. The capital stock is $5,000, and the incorporators are Alden L. McMurtry, John R. Sexton and Harry H. Skerrett, Jr., all of Hartford.

The American Malleables Company, Lancaster, N. Y., has awarded a contract to the Bonnot Company, Canton, Ohio, for the installation of a Holbeck pulverized-coal system in its Owosso (Mich.) plant. This plant has been partly equipped with pulverized coal for some time. The contract was awarded to the Bonnot Company for equipment to serve twenty-four annealing furnaces, three melting furnaces and two small boilers, and provision was made for equipping the core ovens later.

The Standard Underground Cable Company, Westinghouse Building, Pittsburgh, Pa., has filed plans for extensions and improvements to its plant on Sixteenth Street, to cost about $25,000. The J. W. Cowper Company, Oliver Building, is the building contractor.

The American Wireless Company, Windham, Conn., has organized and has elected the following officers: President, Jonathan Starr; vice-president and treasurer, Frank H. Foss; secretary, Mary H. Foss. The capital stock is $30,000, and the company will manufacture instruments and apparatus for aerial communication.

Foreign Trade Notes

ELECTRIFICATION OF THE ENTIRE TOKYO-KOBE TRUNK RAILWAY PROPOSED.—Another large electrification project has been adopted by the Japanese Department of Railways, *Commerce Reports* states, which involves the electrification of the Tokyo-Odawara and the Tokyo-Yokosuka lines. The new project takes in the whole Tokyo-Kobe trunk line. The cost of the entire work is estimated at 67,000,000 yen. Of this amount 35,000,000 yen will be used for construction and improvement of locomotives and cars. The number required is estimated at 291, including freight cars, passenger cars, express locomotives, special express train locomotives, etc. The work is to be started with the erection of cables over the present tracks from both terminals.

INTERCOMMUNAL ELECTRICAL CO-OPERATIVE SOCIETY PROPOSED FOR LIEGE, BELGIUM.—The special commission appointed by the Provincial Council of the Province of Liège in 1920 for the study of the distribution of electrical energy throughout the province, according to the *Electrical Times*, has furnished a report suggesting that an intercommunal electrical co-operative society be formed at once.

MEXICAN LIGHTHOUSES TO BE EQUIPPED WITH WIRELESS OUTFITS.—The installation of small wireless outfits in all lighthouses of the Mexican Department of Communication, according to *Commerce Reports*, is under consideration. Two sets have been installed on trial. If they prove satisfactory, all lighthouses will be similarly equipped.

CONSTRUCTION OF HIGH-TENSION TRANSMISSION SYSTEMS IN FRANCE AUTHORIZED.—The bill authorizing the construction of high-tension transmission systems in France has, according to the *Electrical Times*, been passed by both the Chamber of Deputies and the Senate. The bill aims at making provision for irregularities in power of central stations due to seasonable variations in water supply. Permission was granted by a law of August, 1920, for the construction of connecting systems for the transmission of energy in the liberated provinces of France. Work on that scheme was completed in the north in 1920, but it is expected that work in the east will not be finished until 1923. The Senate adopted various amendments to the bill, one of which empowers the state to take the initiative in the construction of high-tension transmission systems for provision of mutual assistance and co-operation in case of dearth or abundance in individual stations. By the terms of a second the state may purchase undertakings in case of refusal of co-operation by producers and distributors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The representative of an American firm in Italy (No. 3,295) desires to secure an agency for the sale of electric wire, etc.

An agent in Uruguay (No. 3,305) desires to secure an agency for the sale of electrical goods and railway supplies.

A merchant from the Netherlands (No. 3,374) is in the United States and desires to secure agencies for electrical household appliances, telephone booths, etc.

A merchant in Spain (No. 3,377) desires quotations on electrical, photographic, surgical and optical supplies.

ELECTRIC DISTRIBUTION SYSTEM FOR BELGIAN CONGO.—Tenders will be received by the Belgian Ministère des Colonies (Cinquième Direction), 20 Rue de Namur, Brussels, until Dec. 20, the *Electrical Review* states, for the installation and operation of an electric distribution system at Elizabethville, in the Belgian Congo.

STORAGE BATTERIES, MOTOR-GENERATOR, ETC., FOR VICTORIAN RAILWAYS, AUSTRALIA.—Tenders will be received by the Victorian Government Railways Commissioners, Melbourne, Australia, according to the *Electrician*, until Oct. 11 for furnishing an electric storage battery with accessories and spares at the electric light station, Melbourne (Specification No. 35,090); also until Oct. 18 for a static transformer complete with oil and a motor-generator set complete with accessories, to be delivered at the electric light and Pintsch gas station, Melbourne.

ELECTRICAL EQUIPMENT FOR A PROPOSED HYDRO-ELECTRIC STATION IN CZECHOSLOVAKIA.—The Direktion des Stadtlichen Elektricitäts, Kaaden, Czechoslovakia, according to the *Electrical Review*, is asking for bids for electrical equipmen and machinery for a new water-power station at Kaaden.

New Apparatus and Publications

INSULATING COMPOUNDS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a publication (4,249-A) entitled "Westinghouse Proved Insulating Compounds," describing its line of insulating and soldering compounds.

MAGNETO.—The American Bosch Magneto Corporation, Springfield, Mass., has developed a new "F" type waterproof "Bosch" magneto, comprising oscillating and rotary types.

RADIO SUPPLIES.—The Lewis Electrical Supply Company, Boston, has issued Radio Catalog No. 2. It is published in loose-leaf form, and provision is made for the maintenance of a separate price list.

INSULATING MATERIAL.—A new finish for electrical apparatus, known as "Viscolac," has recently been developed by the chemical products division of E. I. du Pont de Nemours & Company, Wilmington, Del.

ELECTRIC CLEANERS.—"Good Housecleaning" is the title of a booklet distributed by the United Electric Company, Canton, Ohio, covering the "Ohio-Tuec" electric cleaner.

STRAIN INSULATOR.—A new strain insulator, "Duro," is now being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

STEEL WINDOWS.—The David Lupton's Sons Company, Allegheny Avenue and Tulip Street, Philadelphia, is distributing catalog No. 110, describing its steel windows for all classes of buildings.

FUEL SAVING.—"Automatic Combustion Control" is the title of a twenty-eight-page booklet published by the Automatic Fuel Saving Company, Philadelphia, combustion engineer and contractor, covering the "Gray" system for economical boiler plant operation.

MOTOR STARTERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, has issued folder 4,500, describing a new line of motor starters recently developed by the company.

BOOKLET ON UTILITIES.—The General Engineering & Management Corporation, 141 Broadway, New York City, is distributing an illustrated booklet, describing its service in constructing, financing and operating public utility properties, and making investigations, valuations, reports, etc.

ELECTRIC CEILING FANS.—The Hunter Fan & Motor Company, Fulton, N. Y., has issued catalog No. 305, describing its electric ceiling fans, ornamental and plain types.

LACQUER.—The Zeller Lacquer Manufacturing Company, 342 Madison Avenue, New York City, is distributing a booklet entitled "250 Lacquer Questions Answered." It should be of value to all who are interested in finishing products of every nature.

STREET-LIGHTING FIXTURES.—Folder 4,500 published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, describes some of the "Westinghouse" lighting fixtures and gives illustrations of a number of its typical city installations.

New Incorporations

THE CAPE MAY COUNTY ELECTRIC COMPANY, Camden, N. J., has been incorporated with a capital stock of $150,000 by Joseph S. Low, H. V. Allgaise, Camden, and Charles M. Bridge, Merchantville, N. J.

THE PENN-JERSEY POWER COMPANY, Jersey City, N. J., has been incorporated by Charles W. Alpaugh, Alfred B. Nelson, Bernardsville, and H. Otto Wittpen, Jersey City. The company is capitalized at $125,000 and intends to construct dams in the Delaware River.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SOUTH BERWICK, ME.—The Berwick & Salmon Falls Electric Company, it is reported, has awarded a general contract for the construction of a hydro-electric plant on the Great Works River, near South Berwick. The equipment will include two vertical-type waterwheels directly connected to electric generators of 425 kva. and 200 kva. Energy generated at the station will be transmitted at 13,200 volts to the present station of the company at South Berwick.

PAWTUCKET, R. I.—The Blackstone Valley Gas & Electric Company is planning to erect a double steel power transmission line from the Tidewater Street plant to the state line to connect with the lines to Woonsocket and future lines interconnecting with other power stations to the east and south.

PROVIDENCE, R. I.—The United Electric Railways Company contemplates the construction of a one-story and two-story, 88-ft. by 250-ft. garage and service building on Melrose Street, to cost about $100,000.

BRIDGEPORT, CONN.—The Atlas Body Works, McKinley Avenue, will build a one-story addition to their power house.

DEVON, CONN.—The Connecticut Light & Power Company, Waterbury, will build a 75-mile transmission line in connection with its proposed generating plant at Devon.

North Atlantic States

AMSTERDAM, N. Y.—The erection of an additional transmission line from the Inghams Mills power station to Oneida County is reported to be under consideration by the Adirondack Power Corporation.

BOLIVAR, N. Y.—The Bolivar-Richburg Electric Company contemplates the erection of transmission lines in Bolivar, Richburg, Wirt and Genesee. The cost is estimated at about $30,000.

BROOKLYN, N. Y.—The Brooklyn Edison Company is having plans prepared for an electric plant at Marshall Street and Hudson Avenue, to cost about $5,000,000. Thomas E. Murray, Inc., 55 Duane Street, New York, is engineer.

BROOKLYN, N. Y.—Benjamin G. Hutchins, Inc., 990 East Thirty-fourth Street, will make extensions and improvements to its power house on East Thirty-fifth Street, to cost about $25,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

BUFFALO, N. Y.—The Sikes Chair Company, 500 Clinton Street, contemplates rebuilding of its power house and factory, recently damaged by fire.

CALDWELL, N. J.—Bids will be received by the purchasing agent, Board of Freeholders, Court House, Newark, until Sept. 19 for electric work in connection with additions and improvements in the Essex County Penitentiary in Caldwell.

PHILLIPSBURG, N. J.—The Eastern Pennsylvania Power Company will build a new substation at Anderson and Grant Streets.

PHILLIPSBURG, N. J.—The Town Commission has adopted an ordinance providing for the installation of a street-lighting system on South Main Street, to cost about $23,000.

FREELAND, PA.—The Pennsylvania Power & Light Company will build a transmission line from Freeland to the Butter Valley district.

LANSFORD, PA.—Work will soon begin on the construction of the new coal-loading docks and storage plant on the Lehigh Canal, near Northampton, by the Lehigh Coal & Navigation Company to replace its present plant at Coalport, to cost about $500,000. It will be equipped with cranes, loading machinery, etc.

PHILADELPHIA, PA.—Bids will be received at Room 216, City Hall, until Sept. 7 for construction and equipment for the Southwest sewage-pumping station, Fortieth Ward, lowland drainage, as follows: Con-

tract No. 1—substructure and superstructure; No. 2—mechanical equipment; No. 3—electrical equipment; No. 4—plumbing system; heating and ventilating systems. Frank H. Caven is director.

PHILADELPHIA, PA. — Plans for the proposed new plant of the Fisher High-Grade Dairies, Inc., 1,935 East Willard Street, to be erected on Worth Street, provide for a power house. William H. Timm, Perry Building, is architect.

PHILADELPHIA, PA.—Plans have been completed for the construction of a power house at the new textile dye works of Walter E. Knipe & Sons, Hancock Street, to cost about $22,000. W. E. S. Dyer, Land Title Building, is engineer.

PITTSBURGH, PA. — Plans have been prepared by the Monongahela Inclined Plane Company for the erection of a power house on Granview Avenue.

TATAMY, PA.—The Tatamy Light, Heat & Power Company contemplates extensions and improvements to its system.

WILMINGTON, DEL.—Bids will be received at the office of the Board of Harbor Commissioners, Municipal Building, Wilmington, until Sept. 8 for mechanical equipment for the Wilmington marine terminals, including light-duty traveling electric portal cranes (2½ tons capacity), portable electric dock winches (2 tons capacity), electric tractor trucks, with two spare battery equipments, trailers for electric tractors, etc.

OAKLAND, MD. — The West Maryland Power Company, recently organized by the West Penn Electric Light & Power Company, Pittsburgh, as a subsidiary, has acquired the municipal electric plant and system. Extensions and improvements will be made. A transmission line will be erected to the upper Potomac and Carroll County coal fields.

MILLVILLE, W. VA.—The Potomac Public Service Company, a subsidiary of the American Water Works & Electric Company, contemplates increasing the output of its local power plant.

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Post Office Department, until Sept. 6 for 1,000 ft. No. 18 fixture wire, single, silk-covered. Also, until Sept. 8 for 20,000 ft. single electric cable, low-tension, 5,000 ft. high-tension electric cable and 5,000 ft. dual low-tension electric cable.

WASHINGTON, D. C.—Bids will be received by the Board of Commissioners until Sept. 12 for 5,500 ft. of telephone and signal cable, as per specifications on file at Room 320, District Building.

WASHINGTON, D. C.—Bids will be received until Sept. 7 at the office of the Public Printer, Government Printing Office, for synchronous converters, 4,500 kw. capacity, 25-cycle, 3-phase, 6,600-volt, together with switchboards, cable, transformers, etc.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Sept. 6 for 100 switchboard lamp caps, 500 binding posts, etc. Also, until Sept. 8 for miscellaneous telephone material called for under Proposal 11838-C-1CP.

North Central States

CADIZ, OHIO.—The property of the Cadiz Electric Light & Power Company has been purchased by the Ohio Service Company, Coshocton. Work, it is understood, will begin at once on the erection of a high-tension transmission line from Dennison to Cadiz.

MARIETTA, OHIO. — Extensions and improvements to the municipal electric light plant are under consideration by the City Council.

TOLEDO, OHIO. — The State Board of Control has given its approval of an expenditure of $20,000 to remodel the power plant at the Toledo State Hospital.

BEDFORD, IND.—The Indiana Quarries Company contemplates rebuilding its plant, recently destroyed by fire. The cost of the new mill with machinery and power equipment is estimated at $350,000.

HAMMOND, IND.—The installation of forty new ornamental lamp standards on Morton Avenue is under consideration by the Board of Public Works.

HAMMOND, IND.—Bids will be received by the Board of Public Works until Sept. 15 for the installation of a complete power piping and steam-heating system in connection with a new pumping station. John Ericson, 30 North La Salle Street, Chicago, is consulting engineer.

HOPE, IND.—Steps have been taken to establish an electric plant in Hope to supply electricity in the towns of Hope and Flatrock. The local plant, owned by Alex. Porter, and the Winterroad plant at Flatrock will be taken over. A high-tension transmission line will be erected from Edina through Hope and Edinburg, which will furnish electricity in both towns and possibly to farmers along the line. The cost of the project is estimated at about $30,000.

INDIANAPOLIS, IND. — The Terre Haute, Indianapolis & Eastern Traction Company contemplates extensions to its power plant on West Tenth Street, including the installation of a 15,000-kw. generator and auxiliaries. Line extensions will also be made.

PEORIA, ILL.—Plans are being prepared by Leonard D. Jeffries, city engineer, for the installation of ornamental lamps on Chestnut and South Adams Streets.

SHUMWAY, ILL.—The installation of an electric lighting system is under consideration by the Village Board. It is proposed to erect a transmission line to Stewardson to connect with the plant of the Prairie Electric Light Company. The cost is estimated at between $7,000 and $8,000.

GREEN BAY, WIS. — Preparations are being made by the Fort Howard Paper Company for the construction of a three-story, 100 ft. x 120 ft. mill addition, with a separate boiler house and power plant, to cost including equipment about $350,000.

HARTFORD, WIS. — Preliminary work has begun on extensions to the power plant of the Kissel Motor Car Company, which will include extension to the power house and the installation of additional generating equipment. The boiler house will be equipped with three 300-hp. Stirling boilers with automatic stokers, coal and ash-handling and conveying machinery. A 175-ft. brick stack will be erected. The cost is estimated at about $100,000. The work is in charge of Cahill & Douglas, 216 West Water Street, Milwaukee, consulting engineers.

LONE ROCK, WIS.—The Village Council has petitioned the Wisconsin Railroad Commission for permission to sell the municipal electric light plant to the Wisconsin River Power Company.

WAUSAU, WIS.—Plans have been completed by the D. J. Murray Manufacturing Company for the erection of a machine-shop and assembly-floor addition, 60 ft. x 230 ft. New equipment, including a 10-ton electric traveling crane, will be installed.

INDEPENDENCE, IOWA.—The Northeastern Iowa Power Company, Clermont, contemplates the construction of a hydro-electric power plant on the Wapsipinicon River, at Independence. The Fargo Engineering Company, Jackson, Mich., is engineer.

MERRILL, IOWA.—The City will install a new street-lighting system. W. E. Buell & Company, Davidson Building, Sioux City, are engineers.

OSKALOOSA, IOWA.—Plans are under way by the City Council for the construction of a municipal hydro-electric plant on the Des Moines River, near Harvey, to cost about $270,000. Bids, it is understood, will be called for after the first of the year. The Fargo Engineering Company, Jackson, Mich., is engineer.

NOVINGER, MO.—The plant and holdings of the Merchants' Power & Light Company have been purchased by the Edina (Mo.) Light Company. The local plant serves the towns of Novinger, Green City, Queen City, Greencastle, Greentop and Tiperary.

ST. JOSEPH, MO.—Negotiations are under way between the City Council and the St. Joseph Railway, Light, Heat & Power Company for furnishing electricity to operate the municipal electric system. If carried through, the municipal generating plant will be closed down.

PORTAL, N. D.—The International Light & Power Company will rebuild the portion of its local power plant recently destroyed by fire.

LEOLA, S. D.—Bonds to the amount of $28,000 have been issued for the installation of an electric light plant and sewer system.

ALLIANCE, NEB. — The Chicago, Burlington & Quincy Railroad, Chicago, Ill., will erect a power house, 48 ft. x 65 ft., at Alliance and will also build an addition to its power house at Lincoln.

ELMWOOD, NEB.—The city will build a transmission line from Elmwood to Murdock, about 8 miles, for municipal service.

MANHATTAN, KAN.—Bids will be called early in September for extension to the ornamental street-lighting system. F. F. Frazier is engineer.

WICHITA, KAN.—Plans for the proposed new high school and manual training building provide for a one-story power house, 60 ft. x 80 ft. The cost is estimated at about $1,000,000.

Southern States

FAYETTEVILLE, N. C.—Arrangements are being made by the Carolina Power & Light Company, Raleigh, for the erection of a 100,000-volt transmission line from Laurinburg to Fayetteville. This line will connect the city with the Blewett Falls plant.

LENOIR, N. C.—Arrangements are being made to change the motive power of the Lenoir Cotton Mill and the plants of the Hudson (N. C.) Cotton Manufacturing Company from steam to electricity. Both are operated by the management.

WINSTON-SALEM, N. C.—The Reynolds-Lybrook Farm Company will construct an electric power plant at its dairy.

WINTERVILLE, N. C. — The town of Winterville has entered into a contract with the Water and Light Commission of Greenville whereby the latter will supply electricity here for a period of five years. A transmission line will be erected to connect with the municipal electric plant at Greenville. The local distribution lines will be rebuilt and a new street-lighting system installed.

DAWSON, GA.—Extensions to the ornamental lighting system are under consideration by the Council.

MIAMI, FLA.—The Pennsylvania Sugar Company, Delaware & Shackmaxon Streets, Philadelphia, is erecting a new sugar mill near Miami. The plans provide for a power house.

HUNTINGDON, TENN.—The Board of Aldermen has decided to purchase a new electric generating unit for the municipal electric plant, to cost from $3,500 to $4,000.

MOBILE, ALA.—Bids will be received by the United States Engineer Office until Sept. 18 for one 1,000-hp. one hydraulic turbine, with governor.

PARRISH, ALA.—The Alabama Power Company is planning to extend its service to Parrish for which an appropriation of $10,000 has been made. A 2,200-volt transmission line will be erected from the substation of the Railway Fuel Company, near Parrish.

PELAHATCHEE, MISS. — The installation of a municipal electric light plant and waterworks system, to cost about $40,000, is under consideration. Swanson-McGraw, Inc., United Fruit Building, New Orleans, La., is consulting engineer.

DE QUINCY, LA.—The Council has called a special election to vote on the proposal to issue $120,000 in bonds for a municipal electric light and power plant and waterworks.

LEESVILLE, LA.—The Council is considering the installation of a municipal electric light and ice-manufacturing plant. E. T. Archer & Company, Shreveport, are engineers.

NEW ORLEANS, LA.—The New Orleans Railway & Light Company, recently purchased by a stockholders' committee for a consideration of $14,500,000, is being reorganized. Plans are being considered for extensions and improvements.

BRADY, TEX.—The Council has authorized the purchase of equipment for an ornamental street-lighting system in the business district.

CORPUS CHRISTI, TEX. — The Gulf Coast Power Company contemplates the erection of a transmission line from Corpus Christi to Victoria and Cuero, connecting at those places with the transmission system of the Texas Central Power. The company is erecting a transmission line from its local plant to Kingsville, via Robstown, Driscoll and Bishop, a distance of 40 miles.

Pacific and Mountain States

KELSO, WASH.—The Long-Bell Lumber Company contemplates the construction of a large mill on the peninsula between the Cowlitz and Columbia Rivers. The plans provide for a 10,000-kw. steam-driven electric generating plant. The mill will be equipped for electrical operation.

PUYALLUP, WASH.—The installation of an ornamental lighting system on Meridan Street is under consideration.

SEATTLE, WASH.—The Puget Sound Light & Power Company will make extensions and improvements to its machine shop and service building at 619 Post Street.

SEATTLE, WASH.—The Council is arranging an appropriation of $500,000, to be

used in connection with the Skagit hydro-electric power plant.

SEATTLE, WASH.—An ordinance has been passed by the City Council providing for the improvement of University Way, including the installation of a street-lighting system.

TACOMA, WASH. — The Council has authorized an appropriation of $35,000, of which $25,000 will be used for the purchase of transformers and $10,000 for the purchase of incandescent lamps.

TROUT LAKE, WASH.—The local electric lighting system has been purchased by C. E. Stead. Improvements to the plant, it is said, are under way.

CANBY, ORE.—The City Council has decided to purchase the plant and system of the Mollalla Electric Company.

SUBLIMITY, ORE. — Preparations are being made by C. E. Taylor for the construction of a power plant on a site between Stayton and Aumsville to supply electricity in this district. Mr. Taylor has been granted a franchise to furnish electricity in the town of Sublimity.

AUBURN, CAL.—The City is negotiating for the purchase of the power plant and system of the Bell Electric Company. If taken over by the city, extensions and improvements will be made.

HANFORD, CAL.—The City Council is considering establishing a municipal electric distribution system. It is proposed to purchase energy from the Southern California Edison Company.

LOMPOC, CAL.—The City Trustees have approved plans for an ornamental lighting system in the business section.

LONG BEACH, CAL.—The Council has authorized plans for an ornamental lighting system on Anaheim Street between Loma and Temple Avenues.

LOS ANGELES, CAL.—Plans are under way for the installation of an ornamental lighting system on Satsuma Avenue and Royal Drive.

MODESTO, CAL.—Bids will be received by the Board of Supervisors for the sale of the electric franchise for the Turlock Irrigation district.

OAKLAND, CAL. — The Pacific Gas & Electric Company will build a one-story substation at Lake Temescal, Oakland.

PASADENA, CAL.—The City Directors are planning to install an ornamental lighting system on Los Robles Avenue.

RIVERSIDE, CAL. — Arrangements are being made by the San Gorgonio Power Company, recently organized, for the construction of three large hydro-electric plants on the south slope of Mount San Gorgonio, near Riverside, to cost about $2,500,000. The company has signed a contract with the Southern Sierra Power Company to furnish electrical energy for distribution in the Imperial Valley. R. R. Scarborough, Los Angeles, is president of the company.

SACRAMENTO, CAL.—Application has been made to the State Water Commission by C. E. Pollock, 1231 G Street, for permission to construct a hydro-electric plant on the Cosumnes River, to cost about $300,000.

SAN BERNARDINO, CAL.—Plans are being drawn for an ornamental lighting system on E Street, to cost about $20,000. C. E. Johnson is city engineer.

TURLOCK, CAL.—Contracts for the erection of an electric transmission line from the Don Pedro dam to Turlock has been awarded by the directors of the Turlock Irrigation district.

Canada

WINNIPEG, MAN.—Plans, it is said, are under consideration for the electrification of the Canadian National Winipeg-Grand Beach line, about 70 miles long. The Manitoba Power Company is reported to have offered to furnish power to operate the railway.

LONDON, ONT. — The Bell Telephone Company is considering placing its wires in underground conduits, at a cost of about $40,000.

RIVERSIDE (VIA WINDSOR), ONT.—The installation of an ornamental lighting system along Riverside Drive, a distance of 4½ miles, is under consideration. The cost is estimated at about $50,000. W. Code, City Hall, Riverside (via Windsor), is engineer.

TORONTO, ONT. — The Hydro Electric Power Commission is receiving bids for three 86,000-hp. hydraulic turbines, to operate under 320-ft. head, for the Queenston plant, to cost about $1,000,000. F. A. Gaby is chief engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 15, 1922)

1,425,755. POLYPHASE CONTROLLING DEVICE; Edward I. Deutsch, Milwaukee, Wis. App. filed May 9, 1917. Single electromagnetically operated device responds to low-voltage and phase reversal.

1,425,781. CONDUIT-COUPLING DEVICE; Homer G. Knoderer, Englewood, N. J. App. filed Oct. 27, 1920. Adapted for boxes of separable hub type.

1,425,784. PLASTIC COMPOSITION AND ARTICLES FORMED THEREFROM; James P. A. McCoy, Milwaukee, Wis. App. filed Aug. 30, 1920. Insulating body made from mixture containing a phenolic condensation product and polymerizable cumaron resin.

1,425,818. REACTIVE VOLT-AMPERE METER; John W. West, Lynn, Mass. App. filed Dec. 20, 1919. Scheme for integrating value of the reactive volt-amperes by use of integrating watt-hour meters.

1,425,837. DISPENSING APPARATUS; D. H. Clark, Orangeburg, N. Y. App. filed July 2, 1921. Electrically heated for drug stores, etc.

1,425,843. CASING FOR ELECTRICAL APPARATUS; W. O. Dwyer, Pittsfield, Mass. App. filed Oct. 22, 1920. Main casing for transformers, etc., completely filled with oil, with auxiliary tank providing for expansion.

1,425,853. SYSTEM OF ELECTRICAL DISTRIBUTION; C. H. Giroux, Schenectady, N. Y. App. filed Oct. 2, 1920. Auxiliary dynamo-electric machine to carry the overload of system.

1,425,858. TEMPERATURE-COMPENSATED REGULATOR; J. H. Hunt, Dayton, Ohio. App. filed Sept. 16, 1920. Electromagnetic device compensates for increased resistance in windings.

1,425,890. AUTOMATIC REVERSING CONTROL; W. L. Merrill, Schenectady, N. Y. App. filed Oct. 14, 1921. Limit switches for controlling reversing switches normally closed and only one temporarily opened at each limit of operation.

1,425,912. CONDENSER AND THE METHOD OF MAKING SAME; R. T. Staples, New York, N. Y. App. filed Aug. 17, 1920. Treating telephone condensers so that their electrical constants are quickly brought to a permanent value.

1,425,917. METHOD AND MEANS FOR PRODUCING OXIDE OF ZINC; J. Thomson, Brooklyn, N. Y. App. filed March 16, 1921. Uses electric furnace.

1,425,918. METHOD AND MEANS FOR PRODUCING OXIDE OF ZINC; J. Thomson, Brooklyn, N. Y. App. filed May 5, 1921. Produced in electric furnace by redistillation of metallic zinc.

1,425,921. TYPEWRITING MACHINE; John Waldheim, Elizabeth, N. J. App. filed Aug. 7, 1919. Return carriage operated by motor.

1,425,924. STORAGE BATTERY; T. A. Willard, East Cleveland, Ohio. App. filed Sept. 16, 1918. Terminals carried out through side walls.

1,425,935. PROCESS OF AND MEANS FOR RECOVERING SILVER FROM PHOTOGRAPHIC AND OTHER BATHS; N. B. Aikerman, Lakewood, Ohio. App. filed May 31, 1919. Electrocouple in solution with resistance medium to receive electrodeposition of metal.

1,425,958. SANITARY MOUTHPIECE; Nathan Gelb, Newark, N. J. App. filed March 15, 1922. Apertures in wall with grooves in outer side with annuli in grooves.

1,425,963. ELECTRICALLY ACTUATED PERMUTATION MECHANISM AND CIRCUITS CONTROLLED THEREBY; J. B. Heller, Wilkinsburg, Pa. App. filed July 11, 1919. For closing one or more electric circuits on motor-driven vehicles.

1,425,968. INDUCTION WATER HEATER; A. J. Holmes, Tacoma, Wash. App. filed May 6, 1919. Circular metal tube for passage of water surrounded by heating element.

1,425,977. TELEPHONE HAND SET; W. C. Kiesel, New York, N. Y. App. filed Dec. 8, 1919. Conducting strips embedded in insulated handle for mechanical strength.

1,425,983. ELECTRIC SOLDERING IRON; F. Kuhn and L. H. Thomas, Detroit, Mich. App. filed March 20, 1922. Tubular body for receiving soldering point surrounded with insulated resistor.

1,426,001. FREQUENCY CHANGER AND GENERATOR OF ALTERNATING CURRENT; N. Oboukhoff, Harbin, China. App. filed Feb. 28, 1917. Two or more dynamo-electric machines mounted on common shaft with primary and secondary windings interconnected.

1,426,015. ELECTRIC PRESS IRON; A. J. Shirk and S. Cohen, New York, N. Y. App. filed April 15, 1920. Iron heated only when on stand.

1,426,065. INSULATING FLAT-WIRE CONDUCTORS; J. A. Heany, New Haven, Conn. App. filed Nov. 16, 1918. Process and apparatus for winding onto conductor.

1,426,071. ARRANGEMENT IN ELECTROLYTIC TANKS WITH DIAPHRAGM CELLS; G. Haglund, Christiania, Norway. App. filed Sept. 10, 1920. Liquid removed from diaphragm cells without intermixing with liquid outside.

1,426,105. COMMUTATOR SEGMENT MOUNTING; W. E. Richter, Toledo, Ohio. App. filed Aug. 8, 1917. Improved means for mounting commutator segments in place.

1,426,123. MOTOR-CONTROL SYSTEM; E. R. Stoekle, Milwaukee, Wis. App. filed March 24, 1919. Control of direct-current railway motors with mercury-arc rectifiers placed on train.

1,426,132. ELECTRICAL MEASURING INSTRUMENT; F. N. Waterman, Summit, N. J. App. filed March 23, 1917. Direct reading of decrements of damped oscillations and wave lengths.

1,426,133. APPARATUS FOR PREVENTING STATIC INTERFERENCE IN RADIO-SIGNALING; R. A. Weagant, New York, N. Y. App. filed Dec. 12, 1917. Static upon one part of antenna system neutralizes static on another part, while signal waves act cumulatively on receiving instrument.

1,426,137. RADIO-GONIOMETER; G. M. Wright, Chesterfield, England. App. filed April 16, 1921. Double search coil with its two windings in planes making an angle of 45 deg.

1,426,141. PROCESS AND APPARATUS FOR ELECTROPLATING; W. E. Belke, Chicago, Ill. App. filed March 15, 1922. Means for filtering out of solution of dirt and dust.

1,426,166. ELECTRIC HEATER; T. M. Feder, Brooklyn, N. Y. App. filed Dec. 7, 1921. Radiant heater screwed into lamp socket and adjustable to any angle.

1,426,187. METHOD OF AND MEANS FOR VAPORIZING FUEL FOR INTERNAL-COMBUSTION ENGINES; W. M. Harrison, Chesthunt, England. App. filed April 21, 1921. Electrical heater which can be applied to induction or air-inlet pipe.

1,426,210. JUNCTION BOX FOR ELECTRIC CONDUCTORS; R. S. O'Neil, London, England. App. filed Sept. 23, 1920. Airtight and watertight case.

1,426,228. HAND MIRROR AND LIGHTING MEANS THEREFOR; Nathan and Max Sloane, Brooklyn, N. Y. App. filed Nov. 29, 1921.

1,426,245. ELECTRIC RESISTANCE HEATER FOR HIGH TEMPERATURES; B. Bauer, Zurich, and A. von Zeerleder, Geneva, Switzerland. App. filed Dec. 10, 1919. Material not affected by high temperatures and electrodes are of similar material.

1,426,293. METHOD OF MANUFACTURING ELECTRICAL COLLECTORS, COMMUTATORS, CONTROLLERS, OR INTERRUPTERS OR EQUIVALENT DEVICES; H. Herrmann, Paris, France. App. filed July 14, 1920. Manufactured by molding.

1,426,311. METHOD OF SOLDERING; J. Moreau, Chicago, Ill. App. filed April 15, 1921. Method for use by jeweler for local soldering.

1,426,323. CONNECTOR; H. R. Saxon, Toledo, Ohio. App. filed March 10, 1916. Made from single metal sheet having focusing arm struck out from sheet.

1,426,334. SELECTIVE RECEPTION OF ALTERNATING CURRENTS; F. E. Pernot and L. J. Rich, Washington, D. C. App. filed March 30, 1922. Separates currents differing in frequency without mutual interaction.

1,426,337. SIGNALING APPARATUS FOR DETECTING SUBMARINES; E. A. Sperry, Brooklyn, N. Y. App. filed July 9, 1917. Net utilized to actuate signal.

(Issued Aug. 22, 1922)

15,436 (reissue). AUTOMATIC FIRE ALARM; F. A. Swan, Cliftondale, Mass. App. filed Aug. 25, 1920. Thermo-electric couples with differentiating thermo-electric battery.

1,426,340. CUSHION FOR TELEPHONE RECEIVERS; O. W. Aagaard, Chicago, Ill. App. filed Jan. 19, 1922. Consists of soft-rubber shell.

1,426,360. ELECTRIC LIGHTING FIXTURE; Le Roy G. Clark, Detroit, Mich. App. filed Dec. 27, 1920.

1,426,367. PORTABLE ELECTRIC MOTOR; O. P. Erhardt, West Haven, Conn. App. filed Feb. 26, 1918.

1,426,384. METHOD OF AND MEANS FOR DETECTING DEFECTS IN PARAMAGNETIC MATERIALS; W. E. Hoke, Washington, D. C. App. filed June 23, 1919. Body subjected to action of magnetic field in presence of finely divided magnetic medium.